CANADA / NEWFOUNDLAND

Burin Peninsula Development Fund Subsidiary Agreement

ENERGY DEMAND AND FUEL PEAT CONVERSION STUDY BURIN PENINSULA

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ENERGY DEMAND AND FUEL PEAT CONVERSION STUDY, BURIN PENINSULA

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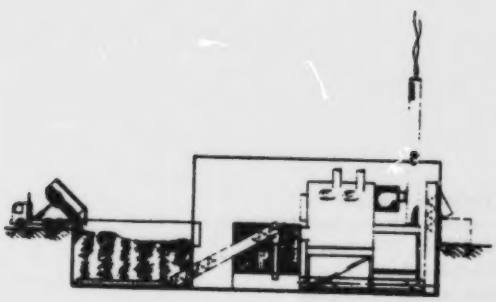

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Burin Peninsula Development Fund Subsidiary Agreement

Regional Development Program

The Burin Peninsula Development Fund was formally established in June 1984 with the signing of the Canada/Newfoundland Burin Peninsula Development Fund Subsidiary Agreement. The main impetus behind the establishment of this special fund was a recognition on the part of both levels of Government of the need to strengthen the area's economy by reducing its dependence on the traditional fishery.

- The two broad, major objectives of the Burin Peninsula Development Fund are:

- To diversify the economic base of the Burin Peninsula;
  and,

- To provide new employment opportunities for the people in the area.

The Regional Development Program is one of the three major programs under the Fund designed to accomplish these objectives.

Disclaimer

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TABLE OF CONTENTS

ABSTRACT i

EXECUTIVE SUMMARY ii

1 INTRODUCTION 1

2 STUDY AND PARAMETERS 2

3 PEAT SUPPLY 4

3.1 THE REGIONAL RESOURCE AND TRANSPORTATION 4

3.2 FUEL PEAT CHARACTERISTICS 5

3.3 FUEL PEAT MINING 6

3.4 TRANSPORTATION 9

3.5 FUEL PEAT COSTS 10

4 PEAT DEMAND 13

4.1 POTENTIAL PEAT USERS 13

4.2 QUESTIONNAIRE RESULTS 15

4.3 USER FACILITY SELECTION 17

5 TECHNICAL FEASIBILITY ASSESSMENT 19

5.1 TECHNICAL BACKGROUND 19
5.1.1 Site Inspection 19
5.1.2 Fuel System Description 20
5.1.2.1 Introduction 20
5.1.2.2 Manufacturer's Proposals 20
5.1.2.3 System Components 23
5.1.2.4 Anticipated Costs 26
5.1.2.5 Code Review 27

5.2 F.P.I. FISHPLANT 28
5.2.1 F.P.I. Fishplant Site Inspection 28
5.2.2 F.P.I. Fishplant Energy Systems Review 31

5.3 MARYSTOWN SHIPYARD 34
5.3.1 Marystown Shipyard Site Inspection 34

TABLE OF CONTENTS

5.3.2 Marystown Shipyard Energy Systems Review . . . 35

5.4 JAMIESON ACADEMY 40
5.4.1 Jamieson Academy Site Inspection 40
5.4.2 Jamieson Academy Energy Systems Review 41

6 FINANCIAL ANALYSIS 44

6.1 INTRODUCTION 44

6.2 FINANCIAL MODEL INPUTS AND ASSUMPTIONS 45

6.3 FINANCIAL MODEL OUTPUTS 49

6.4 FINANCIAL VIABILITY 50

6.5 FINANCIAL SENSITIVITY AND SUMMARY 51

7 CONCLUSIONS AND RECOMMENDATIONS 50

7.1 CONCLUSIONS 50

7.2 RECOMMENDATIONS 51

8 REFERENCES 53

APPENDICES
Appendix 1 - Peat Resource Map
Appendix 2 - Peat Fuel Production
Appendix 3 - Fuel Costs
Appendix 4 - Heating Plant Load
Appendix 5 - Additional Operating Costs
Appendix 6 - Equipment Sizing
Appendix 7 - Annual Energy Savings
Appendix 8 - Life Cycle Cost Analysis
Appendix 9 - Glossary, Abbreviations and Conversion Factors
Appendix 10 - Outline Specifications
Appendix 11 - Terms of Reference
Appendix 12 - Results of Questionnaire Survey

ABSTRACT

Energy Demand and Fuel Peat Conversion Study Burin Peninsula

This study examined (a) the potential for fuel oil displacement by fuel peat on the Burin Peninsula, Nfld., Canada, and (b) the technical and financial viability of converting three facilities; a large fish processing plant, a medium size ship building plant and an elementary school to peat fired systems.

The results of the study indicate that there is an annual light fuel oil displacement potential of 10.4 million litres which would require 40,800 tonnes of fuel peat (50% moisture content - wet basis). A total possible supply of 23.5 million tonnes available within economic range of the major population centres. Complete life cycle analysis was carried out for the three facilities. All three facilities examined; the fishplant the shipyard, and the school are economically viable.

EXECUTIVE SUMMARY

The scope and intent of this study was to determine i) the potential market for fuel peat in the Southern Burin Peninsula area and ii) the technical and financial viability of converting three facilities from oil to fuel peat. The Phase I findings indicate there is a large potential for the use of this indigenous fuel. Phase II shows that with the proper approach, the conversion of existing facilities will result in annual fuel cost savings.

A review of the peatland inventory for the study area was completed by using the following criteria; i) within one kilometer of an existing road network and ii) be at least 50 hectares in size. There are 39 peatfields that meet this criteria, for a grand total of 15,493 hectares of peatland. The estimated volume of fuel peat within the 39 peatfields is 147,673,100 cubic metres.

Before development of the peatfield this in situ fuel is 90 - 95% moisture, and after mining is about 50% moisture. The after mining #2 fuel oil equivalence of the 147,673,100 cubic metres is 6,000 million litres

or 39 million barrels. (An average moisture content of 93% for in situ fuel peat is assumed for this conversion.)

The cost of mining fuel peat was estimated and a price of $43/tonne (at 50% moisture content), was established for an 9,200 tonne per year production level. This production cost of $43/tonne includes transportation to and ash removal from the user facility. The actual price would be a function of moisture content of the fuel, requiring the routine measuring of moisture content. Once production levels reach 20,000 tonnes per annum the cost of production would reduce to approximately $33/tonne (at 50% moisture content).

A survey of industrial, commercial and institutional fuel oil users who are located within the study area, and have an annual fuel oil bill in excess of $10,000 was carried out to determine the fuel peat displacement potential. Forty-nine organizations were queried and seventeen responded. Twelve of the seventeen met the selection criteria of the study and expressed interest in a possible conversion to fuel peat. Buildings owned by both governments were not initially covered in the survey. If the twelve respondents and ten applicable government buildings converted, 5.2 million litres of fuel oil would be displaced, and this would generate a

demand for fuel peat of 20,500 tonnes (@ 50% moisture content) per annum. Realistically the conversion rate would be less than the maximum demand and the actual demand would fall below the 20,000 tonne per annum production goal. Therefore the scope of the survey was expanded to include the residential sector. This sector could consume 41,100 tonnes at 100% displacement of fuel oil. However a 50% displacement is more likely, assuming an acceptance of the fuel in the region equal to that of wood fuel on the Island. Therefore a realizable residential consumption is 20,300 tonnes. The maximum probable potential for annual fuel peat consumption in the region including all sectors is 40,800 tonnes (at 50% moisture content) which would annually displace 10.4 million litres of fuel oil.

Of the industrial/commercial/institutional users who responded to the questionnaire a selection was made of three optimal candidates for this fuel peat boiler conversion feasibility analysis. The following facilities were chosen; Jamieson Academy School - Salt Pond, F.P.I. Fishplant - Marystown, and Marystown Shipyard. These facilities provide a good mix of industrial and institutional heating plant capacities.

The peat fired heating plants were sized based on the heating plant peak seasonal efficiency as opposed to peak capacity. This will result in lower overall annual energy cost and initial capital cost, but will necessitate that 5-15% of the annual heating energy be provided by oil. The limitations for fuel peat conversion identified in the analysis are the relatively low cost of #6 fuel oil (Bunker "C") at the F.P.I. Fishplant as compared to #2 fuel oil (furnace oil), the lack of a central heating plant at the Marystown Shipyard, and the low fuel consumption at Jamieson Academy.

The peat fired heating plant for the F.P.I. Fishplant would consist of a 4,100 kW (419 BHP) steam boiler located in a new building adjacent to the fishplant. The new boiler would supply steam to the steam header in the existing Boiler Room. The normal annual #6 fuel oil consumption would reduce from 1.7 million litres to 85,000 litres.

The peat fired plant for the Marystown Shipyard would consist of a steam boiler in a new building adjacent to the Main Shed with an overhead distribution system to supply steam heating to three other buildings at the

facility. A plant capacity of 2,060 kW (210 BHP) is required. Normal annual #2 fuel oil consumption would reduce from 757,000 litres to 136,000 litres.

A portable peat fired plant in the form of two trailers located next to the existing boiler room would be required for Jamieson Academy. A plant capacity of 393 kW (40 BHP) is required. Normal consumption of #2 fuel oil would be reduced from 126,000 litres to 6,000 litres annually.

Although several manufacturers are available for wood fired systems, only two suppliers of peat fired systems were identified in this study. The fuel peat heating plant costs are higher than might be otherwise expected in comparison to wood systems. The plant costs may reduce as more units are installed in the Canadian Market in conjunction with the development of the resource.

Financial analyses using Life Cycle Costing techniques were carried out to determine the viability of each of the three facilities. Estimates used for the capital costs of the fuel peat plants and the associated annual fuel cost savings in 1991 $ were;

Facility	Capital Cost	Annual Fuel Cost Savings
Jamieson Academy	$ 280,000	$ 28,700
FPI Fishplant	$1,370,800	$204,400
Marystown Shipyard	$1,118,000	$148,800

It must be noted that fuel peat for the heating plants would not be available until six years after the decision to develop the fuel peat resource was made. The analysis assumed a subsidy of $10/tonne peat, for an annual peat production of 9,200 tonnes which would be needed to supply the Fishplant, the Shipyard and the School. No subsidy would be expected if a 20,000 tonnes annual production rate could be attained.

The three installations are justifiable technically and financially. The end result of developing this indigenous resource as a heating fuel will be the development of a local resource, creating new jobs to the benefit of the region, reducing oil consumption to the Province, and reducing energy costs to the consumer.

1 INTRODUCTION

The southern tip of the Burin Peninsula is one of three prime locations for fuel peat development in the Province of Newfoundland. The other locations are the southern Avalon Peninsula, which is the home of the St. Shott's Peat Development Project, and the western end of the Northern Peninsula. Peatlands in the study area of the Burin Peninsula are similar to those in the Avalon, they consist of Blanket Bogs of peat that are high in energy content and relatively easy to recover. The study area location also consists of a number of facilities that can utilize this resource to reduce their energy costs. This report examines the potential market for fuel peat conversion and provides a detailed assessment of three potential users. The results of this study will provide a framework for future fuel peat development projects in the Burin Peninsula area.

This report consists of two components; Phase I: Energy Demand Survey and; Phase II: Conversion Feasibility Study. Phase I identifies the resource potential and the potential fuel peat users in the Burin Peninsula and Phase II identifies the technical and economic factors associated with the conversion of an oil-fired system to peat burning for three facilities selected during Phase I.

2 STUDY AND PARAMETERS

Phase I of the study has been directed at determining the sources of supply of fuel peat, the amount, and the potential consumers in the Burin Peninsula area of the Province of Newfoundland and Labrador. The following items form the main objectives:

1. Determine the peatlands with a fuel peat supply in the southern Burin Peninsula and the amount of fuel peat available per peatland.

2. Determine the approximate cost of producing air dried fuel peat.

3. Determine potential users of fuel peat within the Burin Peninsula area presently consuming in excess of $10,000 per annum of fuel oil.

4. Identify three potential users that would have a high demonstration potential for the equipment and technology associated with a conversion from fuel oil to fuel peat combustion, and a high probability of technical and economic viability.

Phase II of the study deals with an in-depth analysis of the three facilities identified in Phase I. This portion of the study will identify the equipment and technology necessary for fuel peat combustion. In addition a detailed financial analysis will show the comparative costs of fuel peat with fuel oil. The objectives of Phase II are itemized as follows:

1. To develop preliminary designs for each of the facilities including;
   a) site inspection of each facility,
   b) optimization of fuel peat combustion plant at the site,
   c) fuel peat off-loading, and storage silo,
   d) fuel peat combustion plant sizing, and
   e) enclosing building if required and other ancillary equipment.

2. To generate a capital cost estimate.

3. Identify impact on operating and maintenance costs.

4. To complete an in-depth financial analysis of each site using Life Cycle Costing analysis.

3 PEAT SUPPLY

3.1 THE REGIONAL RESOURCE AND TRANSPORTATION

The peatlands of the Burin Peninsula are typically blanket bogs, vary in thickness from 1-3 metres, and are generally treeless and free of ponds.[13] All of these are favorable features for resource development[15]. The area has the highest annual rainfall (135 centimetres) and fog frequency (1,145 mean annual hours of visibility 0.8 km or less) for the Island of Newfoundland[16]. These are impediments to the air drying of peat.

A review of preliminary reconnaissance data of the peatland resource of the southern end of the Burin Peninsula (the area of the study) shows that there are 15,493 hectares (ha), of accessible peatlands (Appendix 1). Accessible peatlands are for the purposes of this study within one kilometer of an existing road and at least 50 ha in size. The volume of fuel peat in this 15,493 ha is 147.7 million cubic metres (Appendix 1). At an annual production of 20,000 to 40,000 cubic metres of fuel peat the potential of this nonrenewable resource is large, and this potential is much larger when less accessible peatlands are included.

3.2 FUEL PEAT CHARACTERISTICS

Peatlands are composed of horticultural peat and fuel peat with a vegetation overburden. The classification is related to the degree of decomposition of the peat and its biological origin. Fuel peat is more highly decomposed and has a higher energy content than horticultural peat. In-situ, peat (in the ground) has a high moisture content, (90 to 95% of the material by weight is moisture).[5][18] The fuel peat is dried to raise the energy content per unit mass and increase the viability of the fuel.

The energy content of fuel peat depends upon the degree of decomposition, bulk density, ash content, and water content.[5] The energy content ranges from 5,900 - 6,700 kiloJoules per kilogram (kJ/kg) at 60% moisture content (M.C.) to 11,350 - 12,650 kJ/kg at 35% M.C..[5] For the purposes of this report we are using 10,000 kJ/kg at 50% M.C..[5][10] The moisture content is a reasonable estimate of what can be expected with a commercial production effort in the study area.[19] The actual energy content of the fuel peat from the proposed production area would not be known until the peatfields were sampled and a heat value combustion

test was completed. For comparative purposes the fuel peat produced at St. Shotts' has a heat value of 9,572 kJ/kg at 50% M.C.. Furnace oil (#2 fuel) has an energy content of 40,000 kJ/kg.[17] Therefore, 4.7 kilograms of fuel peat at 50% M.C. has an equivalent energy content equivalent to one litre of furnace oil.

In summary fuel peat is a biomass that is comparable to softwood. The energy content per unit weight of fuel peat at 50% M.C. is comparable to softwood at 50% M.C..[18][5]

3.3 FUEL PEAT MINING

The extraction of fuel peat requires appreciable development of the peatland before mining can commence. The moisture content of the resource has to be reduced to facilitate mechanized operation and subsequent air-drying.[5] This is accomplished by ditching the perimeter of the production area and within the area itself to produce a drainage network. The drainage network normally consists of regularly spaced (20 metre) V-shaped field ditches.[8] The optimization of the ditch spacing is presently being undertaken at the St. Shotts' demonstration project.[20]

The transfer of production technology to the Newfoundland climate is not yet complete. It is expected that three to five years of drainage is required before the average moisture content of the production area will be low enough to accommodate a fuel peat extraction of two "harvests" per production field per year.[19][21] There are indications that the time-scale of the field drainage can be shortened to two or three years if less intensive peat extraction, one "harvest" per year, is acceptable.[19][20][21] Annual maintenance of the ditch walls to repair any foundering is an ongoing requirement.

Once the production area has been sufficiently drained to allow the operation of machinery the overburden (horticultural peat and vegetation) is normally removed, and the peatfield surface is profiled towards the drainage network to facilitate surface runoff of rainfall and drying.

A production method equal to the St. Shotts program utilizing the Herbst technology is envisioned. An extruding machine will extract fuel peat and extrude cylindrical peatbricks (sods) onto the surface of the peatland. The air-drying of the sods commences with routine rotation of each sod to promote drying. It is

assumed that using this method and two extractions per production area per year that 50% moisture content fuel peat can be delivered to the consumer's plant.

The Winterland area west of Marystown is identified for the proposed production area. It is reasonably close to the urban areas of Marystown and Burin (within 15 kilometers) and there are ten peat fields greater than 50 hectares in size in the immediate area that are within one kilometre of an existing road. As well, the Marystown/Burin region is identified in Section 4 as the prime region for fuel peat production.

Either of Sites 2 to 11 near Winterland (See Appendix 1) could be used. A detailed survey of the ten peatfields is required to determine the most viable site (expected lowest production cost). If neither of the peatfields prove acceptable following the detailed survey, another region of the study area should be surveyed. Once an acceptable peatfield is identified, (eg: sufficient quantity of fuel grade peat, terrain conducive to drainage, and sufficient depth of peat) a preparation plan is required; including design and location of an access road, of perimeter drainage and field drainage. After the design work is complete the preparation of the production area can begin.

3.4 TRANSPORTATION

Due to the relatively adverse air-drying conditions on the Burin Peninsula, (high occurrence of fog and of rainfall), the removal of the fuel peat from the peatland has to be flexibly planned. It is planned that the fuel peat producer will have sufficient fuel storage capacity to hold a large portion of the annual consumption (say 70%). Mounds of dried sod with tarp covers is envisioned at the mining site. This would allow for the supply of fuel peat to consumers during the non-production period between November and June and during inclement weather during the production season. The user facility, as a result, would require stockpiling no more than one week's consumption of fuel peat.

The collected sod would be taken off the production area in tractor-trailer wagons. The wagons would be unloaded into either a site stockpile, or tandem dump trucks or trailing dump trucks for transport to the consumer's silo.

The actual transport mechanism would have to be determined as no data are available for transporting fuel peat in the Province. For this study we are assuming an estimated cost of $4.00/tonne (Appendix 2) for

transporting fuel peat from the production area in bulk form to the consumer's silo over a distance not greater than 15 kilometers. It is estimated that $6.00/tonne (Appendix 2) would cover the transportation cost of delivery over a 60 kilometre distance.

3.5 FUEL PEAT COSTS

The extraction of fuel peat in the Province of Newfoundland and Labrador is not a mature technology. Hence there is no firm cost data available for production costs to be used in this study. The viability of displacing fuel oil for heating with fuel peat is critically dependent upon the economical delivery of fuel peat to a consumer.

It is expected that the production cost of peat fuel will be similar to other biomass production costs, typically wood in the form of wood chips. Wood chips are presently being sold in the Province (Clarenville and Gander).

It has been estimated that a fuel peat development operating from a 50 ha peatfield designed for two "harvests" annually to meet a yearly consumption of

6000 tonnes (at 50% moisture content) would produce the fuel at $45/tonne (Appendix 2). Transportation costs would raise this cost to $49/tonne.

The analysis in Appendix 2 uses a discount rate of 20% while the balance of the financial analysis in the report uses 10%. The net effect of the higher discount rate is the need for a higher price per tonne for the mining operation to be economical. The reasons for choosing the higher rate is the short life of a peat field development (10 - 15 years) versus a heating plant (in excess of 20 years) and the higher risk associated with the development (inexperience, quality of fuel, etc.)

The annual fuel peat consumption of the three proposed peat boiler plants discussed in Section Five would be 9200 tonnes. The unit production cost would reduce to $39/tonne delivered (as iterated from Appendix 2, Typical Production Cost Curve). Including transportation, the unit cost to the user would be $43/tonne. The peatfield production area must be increased to 75 hectares to meet an annual production of 9,200 tonnes.

Further economy of scale in the mining of fuel peat gives a reasonable projection of $33/tonne, including transportation, for an annual production in excess of 20,000 tonnes. For this study, the cost of $33/tonne of fuel peat is being used for the financial analysis, assuming a production subsidy of $10/tonne. This subsidy would amount to $92,000 annually for the three peat fueled plants discussed in Section 5.

4 PEAT DEMAND

4.1 POTENTIAL PEAT USERS

Fuel peat is a resource of immense potential to the Province of Newfoundland and Labrador. The Burin Peninsula is a region of high concentrations of the resource.[14] Peat has in the past and is presently being used on the Burin Peninsula and elsewhere on the Island as a heating fuel. This use has generally been in areas lacking abundant forest resources. The burning appliance in use is solid fuel type ("wood" stove) which typically require manual stoking of the combustion process and manual fuel loading.

The advent of high fuel oil costs in the 1970's led to the development of fuel peat burning technologies that allow for automated operation and as a result this indigenous fuel can now be used in existing commercial-/industrial/institutional facilities using central heating plants for space or process heating.

The heating distribution equipment in an oil fired heating plant is conducive to the add-on of a fuel peat boiler. Electric facilities are candidates only if the energy is distributed in the facility by steam water

or hot air systems (ie: not electric space heaters). New construction can readily incorporate fuel peat technology into the building and/or boiler design.

As required by the Terms of Reference (Appendix 11) a list of the potential peat users was compiled so that (a) the total oil displaced by the peat could be approximated for Phase One and (b) the cost of peat production then estimated for inclusion in the financial analysis of the potential sites for Phase Two of the study.

The list of potential users was compiled from the Department of Mines and Energy Standard Industrial Classification (SIC) files for the Burin Peninsula and included all sectors of oil energy consumers (i.e.: institutional, commercial and industrial). Potential users were first culled by eliminating those in areas outside the toe of the peninsula because of the lack of accessible fuel peat bogs close to such potential users or because of the lack of a major potential user nearby.

4.2 QUESTIONNAIRE RESULTS

In order to identify the quantity of fuel oil presently consumed in the study area, a questionnaire was prepared and sent out to 49 organizations in the area around the toe of the peninsula including Marystown areas, Lamaline, Grand Bank and Winterland. The purpose of the questionnaire was to identify facilities consuming at least $10,000 per year of fuel oil.

There were two questionnaires developed for the survey. Questionnaire 'A' asked for energy usage and the most important considerations; room to maneuver a peat delivery truck (typically a large dump truck) and space for outdoor peat storage. Questionnaire 'B' was identical to Questionnaire 'A' except that energy usage was not requested. The energy usage figures for Questionnaire 'B' were already available from the government files. An example of the letter of transmittal and the two questionnaires are found in Appendix 12.

Response to this questionnaire was 35%. with seventeen respondents indicating favourable interest and twelve actually meeting the questionnaire criteria. Appendix 12 has the detailed breakdown of the questionnaire responses. Government buildings consuming at least $10,000 per annum of fuel oil were identified after the

survey. There are ten applicable buildings in the study area. The results of the data search are included in Table 4.1. It was felt that this fuel oil consump-

Table 4.1 Summary of Potential Peat Demand *

Contact Name	Business	Location	Litres	Tonnes
Burin Integ. Sc. Brd.	Harfett School	Salt Pond	33,663	131
Burin Integ. Sc. Brd.	Partanna Acad.	Grd. Bank	104,825	409
Burin Integ. Sc. Brd.	Jamieson Acad.	Salt Pond	126,124	493
Burin Integ. Sc. Brd.	Seaman's Elem.	Garnish	34,545	135
Burin Penin. Drycls.	Laundry	Fortune	20,000	78
Burin RC School Brd.	Holy Name of M.	Marystown	60,000	234
Burin RC School Brd.	St. Pat's Elem.	Burin	52,890	207
Burin RC School Brd.	Holy Name of M.	Marystown	54,980	215
Federal Govt.	G.O.C. Bldg.	Grd. Bank	6,440	25
Federal Govt.	Post Office	Marystown	4,200	16
FPI Fortune	Fish Process	Fortune	1,457,844	5,695
FPI Grand Bank	Fish Process	Grd. Bank	357,021	1,395
FPI Marystown	Fish Process	Marystown	1,719,207	6,716
Housing - Burin	470 Residences	Burin	1,630,900	3,186
Housing - Fortune	405 Residences	Fortune	1,405,350	2,745
Housing - Garnish	175 Residences	Garnish	607,250	1,186
Housing - Grd. Bank	660 Residences	Grd. Bank	2,290,200	4,473
Housing - Lamaline	305 Residences	Lamaline	1,058,350	2,067
Housing - Marystown	775 Residences	Marystown	2,689,250	5,252
Housing - St. Law.	240 Residences	St. Law.	832,800	1,626
Marystown Shipyard	Ship Building	Marystown	602,130	2,352
Provincial Govt.	DVS Burin	Burin	238,483	932
Provincial Govt.	Highways Depot	Burin	19,075	75
Provincial Govt.	Cottage Hosp.	Grd. Bank	77,915	304
Provincial Govt.	Nursing Stat.	Lamaline	19,020	74
Provincial Govt.	Cottage Hosp.	St. Law.	86,184	337
Provincial Govt.	Clinic/Hosp.	Burin	41,041	160
Provincial Govt.	New Burin Hosp.	Burin	114,467	447
St Lawrence RC Par.		St. Law.	18,850	74
	Total		10,446,056	40,805

* NOTE: Only 50% of fuel oil usage in residential sector for each of seven areas is converted into fuel peat demand in tonnes.

tion tabulation was inadequate to determine the true oil displacement potential in the region. Therefore the sample was broadened to include the residential sector in each of the major communities. Statistics Canada was used to identify the fuel oil consumption by residences in the study area.

4.3 USER FACILITY SELECTION

To analyze the technical/financial viability of the use of peat fueled heating plants three organizations who responded to the questionnaire and were viewed as optimal candidates were chosen. The selection of the three organization heating plant facilities involved the following criteria:

i) annual fuel consumption in excess of $10,000,

ii) existing facility within 15 kilometers of an "accessible" peat field, and

iii) close proximity to other potential candidates, so that the cost of one peatfield development could be justified by the peat demand from several users.

The four regions of the study area from which questionnaires were returned are; i) Marystown/Burin, ii) Grand Bank/Fortune, iii) Lamaline and iv) St. Lawrence. The first two regions offer the most potential with the Marystown/Burin area chosen. The three facilities selected were; Jamieson Academy - Salt Pond, FPI Fishplant - Marystown, and Marystown Shipyard. Besides meeting the selection criteria, the chosen facilities offer a range of plant capacities, and a mix of institutional/industrial ocupancies.

5 TECHNICAL FEASIBILITY ASSESSMENT

5.1 TECHNICAL BACKGROUND

5.1.1 Site Inspection

Based on the results of Phase I - Energy Demand Survey, three sites were selected for the assessment of the feasibility of conversion to peat burning systems. From the seventeen respondents to the questionnaire the facilities selected were the F.P.I. Fishplant, Marystown; the Marystown Shipyard; and Jamieson Academy, Salt Pond. These sites were visited to assess the technical viability of fuel peat conversion. Heating plant data and operation schedules were recorded and the installation limitations of the proposed peat burning systems were examined. Discussions were held with operation personnel to obtain this information and assess the integration of peat burning systems with the existing oil fired plants.

Summary:

Limitations to the installation of a peat burning system for the three examined facilities consist of:

Low Cost for No. 6 Heavy Oil: F.P.I. Fishplant

Lack of Central Heating Plant: Marystown Shipyard

High Capital Cost per Heating Plant Capacity: Jamieson Academy

5.1.2 Fuel System Description

5.1.2.1 Introduction

This section summarizes the information obtained from resource libraries and manufacturers of peat burning systems. This information was used to specify a peat burning system that will permit accurate budgeting for the project. A preliminary estimate was determined to facilitate the life cycle cost analysis.

5.1.2.2 Manufacturer's Proposals

Several Manufacturers were contacted and asked to provide technical and estimate information for conversion at the three selected facilities. Based on our discussions with potential manufacturers, a list is arranged in order of greatest to lowest interest:

KMW, Inc.: London, Ontario

Volcano, Inc.

LAMB Cargate Industries Ltd: New Westminster, B.C.

North FAB Systems Ltd: Stratford, Ontario

Babcock & Wilcox Limited: Montreal, Quebec

BDR Machinery Ltd: Mississauga, Ontario

KMW Incorporated was the most helpful in offering suggestions for the three selected facilities. KMW Incorporated (formerly Anga & Varme SwedeStoker) is a European Company that is also well established in North America. It also has the advantage of being the only manufacturer (other than Volcano) with a local agent in the Province for sales and service. The product line is well documented and consists of a range of heating plants capable of burning a range of biomass products including peat, chips, bark and sawdust. The company has a list of numerous installations in North America, many of which are in Atlantic Canada. A Proposal is included in the appendix for the three facilities selected.

The local agent of KMW Incorporated also represents the Volcano line and has suggested that the Volcano manufacturer specializes in much larger heating plants than the three facilities investigated. Consequently no additional information was requested for the Volcano Ltd. peat burning systems.

LAMB Cargate Industries Ltd. and North FAB Systems Ltd. did show some interest in peat burning systems, although information was not provided in time for inclusion in this report. These two companies have installed wood burning systems in the province.

BDR Machinery Ltd. (a wood chip fired boiler manufacturer) has the lowest interest in the group and is generally not interested in peat burning systems.

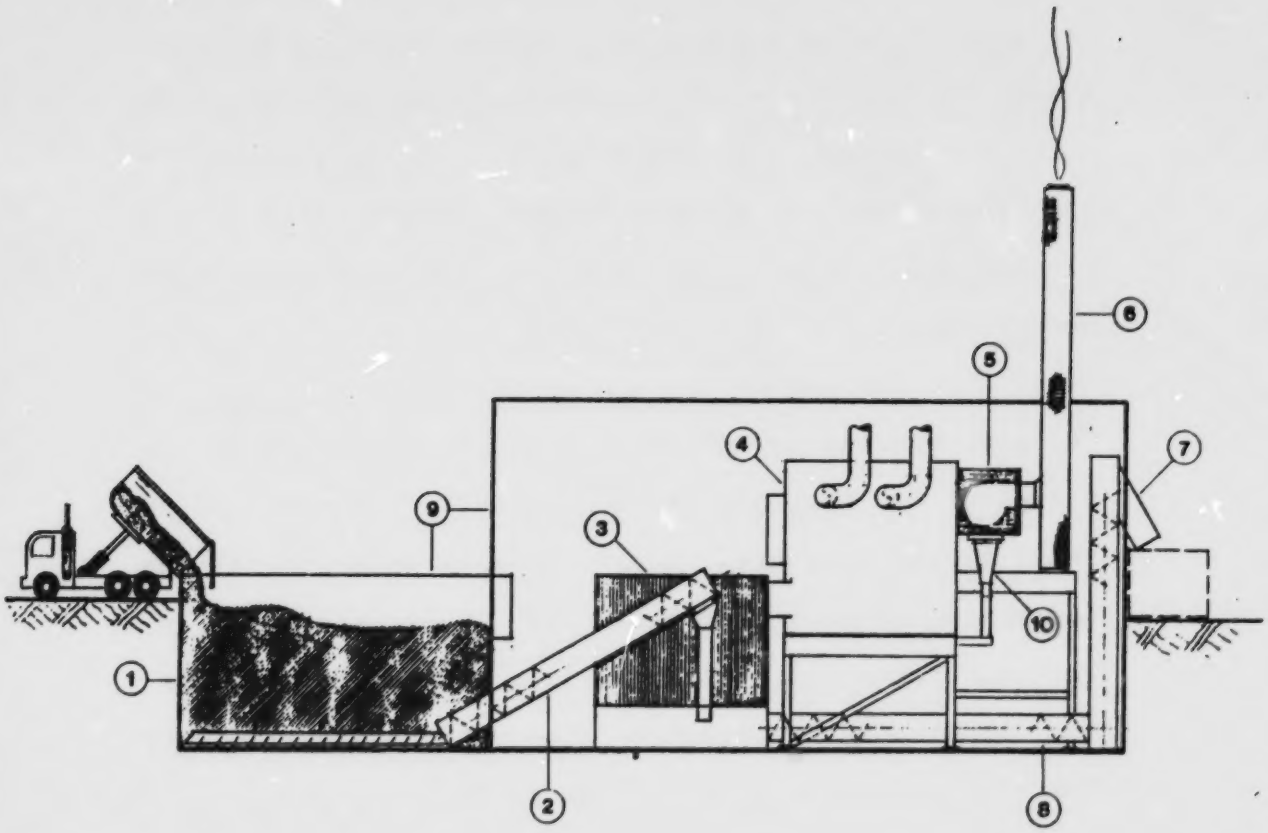
Well established boiler manufacturers such as Weil-McLain and Cleaver Brooks were contacted but are not manufacturers of peat burning systems. Cleaver Brooks did mention however that they are experimenting with it. There appears to be several manufacturers in the European community that are not yet established in the Canadian Market. No attempt was made to contact these companies since it is a disadvantage for future service, and maintenance to have a plant installed with no local agency to represent them.

5.1.2.3 System Components

There is some variance in system design and arrangement for peat burning systems of varying capacity and between the various manufacturers, a typical layout is shown in Figure 5.1. This particular arrangement is typical of what is offered by KMW Incorporated and is similar in concept by what is offered by other manufacturers.

The peat burning system shown could be installed in the Fishplant or Shipyard with the heat transfer medium being medium pressure steam. This arrangement has the advantage of having a below grade fuel storage silo. This concept minimizes the filling effort for loaders, and moderates temperature fluctuations to eliminate frost or excessive heat buildup in the fuel.

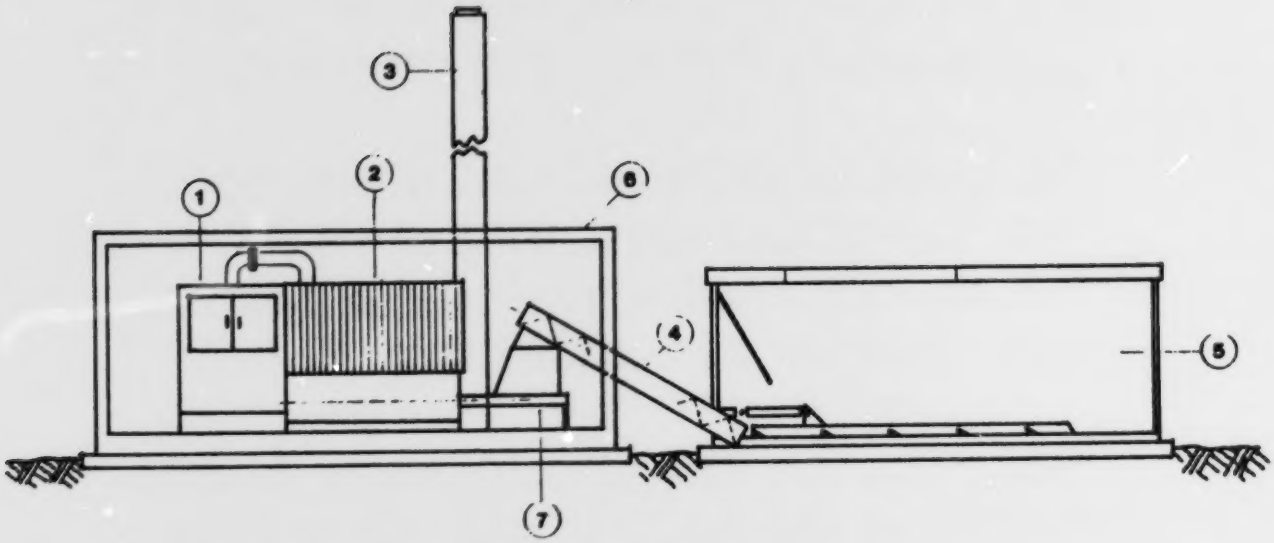
The peat burning system for the school should consist of what is designated as a "portable" unit as shown in Figure 5.2. This system would consist of two (or three) trailers that are self contained heating plants and are simply located at site and tied into the existing heating plant. Both components would be above grade and the costs should be minimized by this "packaged" approach which will usually be available to the smaller range of



1. SILO
2. CONVEYOR
3. COMBUSTION CHAMBER
4. HEAT EXCHANGER
5. FAN
6. STACK
7. ASH DISCHARGE
8. ASH CONVEYOR
9. SILO/HEATING PLANT BUILDING
10. FLY ASH COLLECTOR

PEAT BURNING SYSTEM

FIGURE 5.1



1. BOILER
2. COMBUSTION CHAMBER
3. STACK
4. CONVEYOR
5. STORAGE SILO
6. HEATING PLANT BUILDING
7. STOKER SCREW

PEAT BURNING SYSTEM

(PORTABLE UNIT)

Figure 5.2

boilers. A brief description of the outline system specifications for each facility is listed in Appendix 10.

5.1.2.4 Anticipated Costs

The anticipated costs for the installation of the three peat burning systems are estimated in 1991$ to be as follows: F.P.I. Fishplant, $1,370,800; Marystown Shipyard, $1,118,100; and Jamieson Academy, $280,000.

These costs will have to be reassessed immediately prior to the final design or tender call since any or all of the projects will not be going ahead until five years after the strategic decision to develop the resource.

Sections 5.2 to 5.4 describe in detail the individual differences which account for the variance in costs of each of the three selected facilities.

5.1.2.5 Code Review

The installation of the proposed peat burning systems will be subject to numerous codes, regulations and standards imposed by the Federal, Provincial and Municipal Governments. Among those codes involved are:

National Building Code of Canada (1985); National Fire Code of Canada (1985); Canadian Electrical Code; National Fire Protection Association (NFPA); The Nfld. Dept. of Labour and Manpower Boiler and Pressure Vessel Act; Newfoundland Air Pollution Control Regulations; ASME Boiler and Pressure Vessel Code; ANSI Codes; Occupational Health and Safety Act; CSA; ULC; Municipal Bylaws; District Fire Commissioner

The systems proposed by the various manufacturers can be designed to meet all of the applicable codes and regulations. The final design must be submitted for approval and registration prior to the installation.

One possible concern is additional costs that may be incurred by increasing the total heating plant capacity for the selected facilities. The costs would result from a possible regulatory requirements of additional operators or of more highly qualified operators. In the case of the F.P.I. Fishplant, operators are already

required and the additional load of a peat fired system should not change the present requirements. The impact on operating costs for Jamieson Academy is eliminated by ensuring that the net installed capacity of hot water boilers does not exceed 1,800 kW. In discussions with the Department of Labour during preliminary design of the peat fired system for the Marystown Shipyard it appears that the operator requirements does not increase.

5.2 F.P.I. FISHPLANT

5.2.1 F.P.I. Fishplant Site Inspection

A minor constraint to the installation of a peat burning system is the space availability immediately in front of the boiler room. The final layout of the peat burning system should be arranged to minimize restrictions on this access road. Figures 5.3 and 5.4 illustrate the proposed location of a peat burning system. The distribution medium would be steam supplied by insulated pipes passing into the boiler room and tying into the existing heating system. At this point it is assumed that the existing heating plant will remain unchanged as it is required to

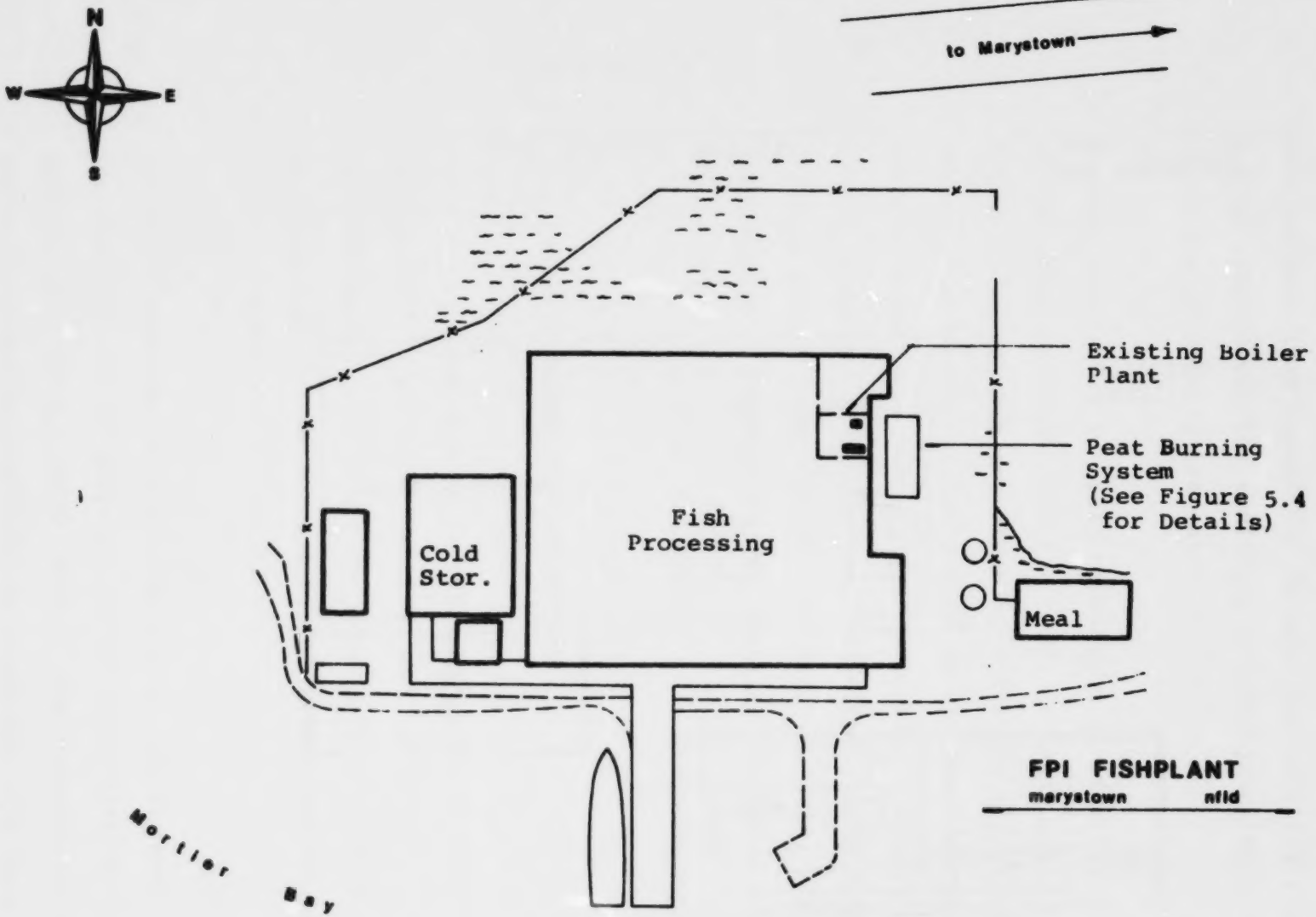
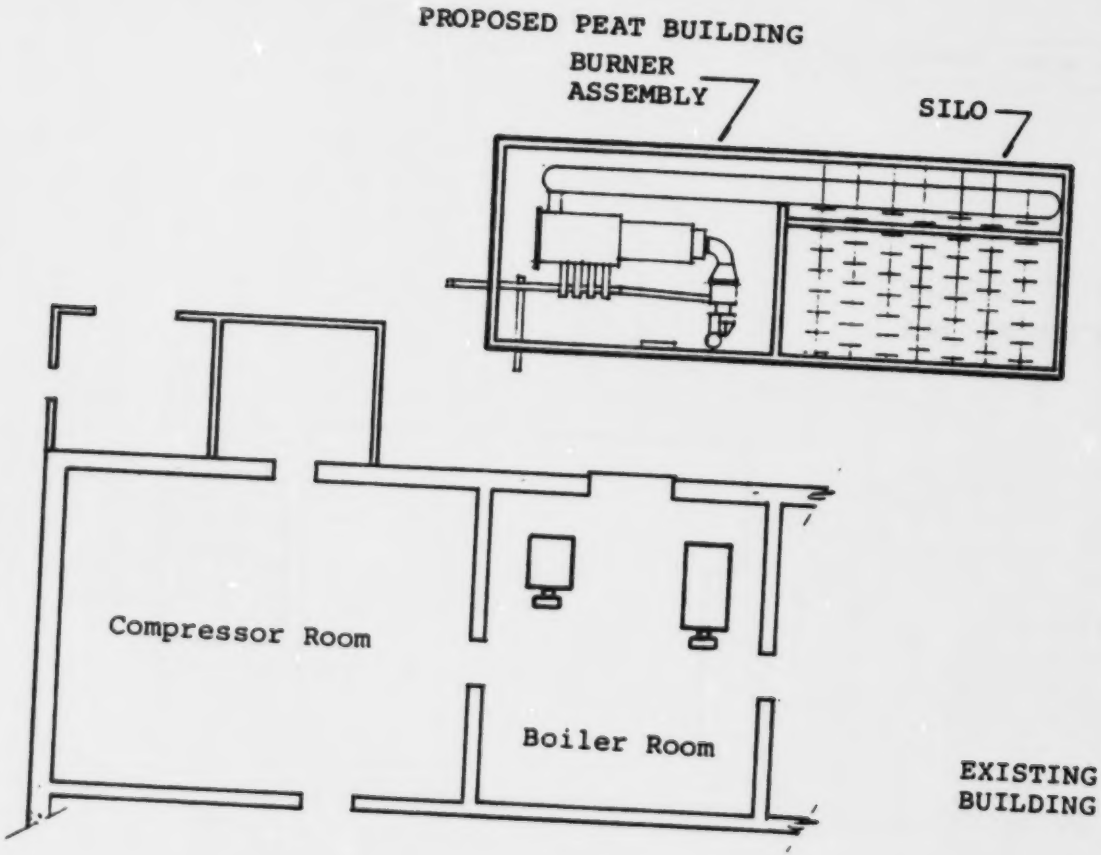


FIGURE 5.3:SITE PLAN



PEAT BURNING SYSTEM

FPI FISHPLANT
marystown nfld

FIGURE 5.4

provide peak load capacity. As well the existing plant can be used to provide auxiliary or emergency heat (in the event of peat system failure).

A major limitation to peat conversion is the low cost of the existing fuel source. No. 6 Heavy oil is 8% higher in energy content than No. 2 light oil (42,390 kg/L versus 38,976 kJ/1) and up to 25% less costly by volume ($.261/1 versus $.352/1). Further details are found in Appendix 3. The combined effect is a longer payback period in dollar savings at the F.P.I. Fishplant as compared to a similar fishplant using (No.2) light oil.

5.2.2 F.P.I. Fishplant Energy Systems Review

The F.P.I. Fishplant in Marystown uses No. 6 Heavy oil (Bunker "C") for both heating and production. The heating plant consists of two steam boilers which are designated as Boiler #1 and Boiler #2 for the purposes of this report.

Boiler #1 operates as a standby boiler and is used only for heating. It is operated mainly after working hours when Boiler #2 is shut down. The capacity of this boiler is 1,800 kW (183 BHP) at 1,034 kPa (150 psi) and

159 lph (42 USGph) net input. The output is equal to 1,472 kW (150 BHP) at an operating pressure of 79 kPa (11.5 psi).

Boiler #2 is the larger boiler and is used during working hours for production and heating. The production needs consist of drying ovens that prepare meal for agricultural purposes from the waste fish by-products. The capacity of this boiler is 7,200 kW (734 BHP) at 1,034 kPa (150 psi) and 634 lph (167.5 USGph) net input. The operating pressure is 552 kPa (80 psi) and the output capacity is equal to 5,886 kW (600 BHP). The operators at the fishplant estimate that approximately 1/3 of the oil consumption is for heating and 2/3 is for production. The annual fuel consumption is expected to average 1,705,000 l/yr (375,000 GAL/yr). Since Boiler #2 provides some heating (during working hours) and all production heat, it is estimated that 80% of the fuel consumption is for Boiler #2 and 20% is used for Boiler #1 for space heating during unoccupied period and shutdowns. The fishplant is in production for up to six days per week and eleven months per year. The shifts vary from eight to sixteen hours per day.

The fishplant operates satisfactorily with Boiler #2 running during production periods and Boiler #1 otherwise. The heating plant capacity for fishmeal

production was calculated based on 1) an estimated production hours of 3,500 hours/year and 2) two-thirds of the fuel consumption used for production, and is expected to be 2,669 kW (272 BHP). The heating plant capacity required for space heating was calculated based on 1) the degree day method and 2) one-third of the total fuel consumption being used for heating, and is expected to be 1,440 kW (147 BHP). The analysis of the loads of the boiler plant can be found in Appendix 4. It is felt from this analysis that Boiler #2 is oversized in relation to the process and heating requirements while Boiler #1 is sized sufficiently to provide auxiliary heating during non-working hours. A detailed breakdown of peat plant sizing for the heating and production requirements is shown in Appendix 4. The total expected heating plant capacity should therefore be 4,109 kW (419 BHP), much less than the capacity of Boiler #2 which is 7,200 kW (734 BHP).

The peat fired boiler can be sized based on the peak heating capacity (100% fuel oil displacement) or peak seasonal efficiency (oil fired boiler would be required to meet peak load). It is more advantageous to size for the peak efficiency rather than the peak capacity.[9] As a result the annual efficiency of the peat burning system will be higher and the net energy cost and heating plant capital cost will be lower. It is shown

in Appendix 4 that the minimum to maximum output load of the existing oil fired plant can vary from 2757 to 5445 kW (281 to 555 BHP). A peat fired plant of 4100 kW (419 BHP) would be the optimum size for minimum peat plant overall energy costs.

5.3 MARYSTOWN SHIPYARD

5.3.1 Marystown Shipyard Site Inspection

The major limitation at the shipyard is the lack of a central heating plant at the facility. Two thirds of the annual heating fuel oil is consumed by the central building (Main Shed). The balance is consumed by three other buildings. Unfortunately, the Main Shed contains six oil fired hot air units located throughout the building and there is no existing distribution system that a future peat burning system could tie into for the other three buildings.

There appears to be no physical limitation for the installation of a peat burning system facility. There would however be cost and space limitations to be considered if a distribution system were installed. Figures 5.5 and 5.6 illustrates the Main Shed of the Marystown Shipyard. It is expected that a central peat

fired system could be installed on the southern side of this building with a steam distribution system sized to pick up the average load of the Main Shed, and the full load of the Outfitting, Service and Office Buildings.

5.3.2 Marystown Shipyard Energy Systems Review

Operation and space heating needs are provided by oil (No. 2 light) fired boilers with steam, hot water and warm air distribution systems. The heating plants are characterized in Table 5.1:

Table 5.1 Shipyard Oil Fired Heater Descriptions

Boiler Type	Boiler Location	Boiler Capacity		Boiler Fuel Consumption
		kW	BHP	l/yr
Steam Boiler	Service Bldg	589	60	71,700
HW Boiler	Outfitting Bldg	1,532	156	130,500
HW Boiler	Main Office	117	12	54,500
Hot Air Furnace	Main Shed (6)	3,955	404	500,000
TOTAL				756,700

The lack of a central heating plant is a severe limitation for the installation of a peat burning system. The installation of several peat burning systems or a heat distribution system are expensive options to

consider. The best potential to reduce oil consumption is to install a peat burning system for the Main Shed (since this accounts for 66% of the Shipyard's total fuel consumption) and a distribution system to the other buildings (if the distribution installation per building can be justified). The additional expense for above ground heating distribution to the buildings from the Main Shed (in 1991 $) are: Outfitting Building, $187,000; Service Building, $137,700; and Office building, $45,500.

The Office Building appears to be cost effective primarily due to the small distance (and therefore cost) involved with above ground district heating lines. Of the $45,500 expense shown, $30,000 is for increased peat fired heating plant capacity to meet the load of this building and $15,500 is for the distribution system. The Outfitting Building is not as cost effective due to the greater distance involved with the district heating system. The distribution system cost is $62,000 and the balance is allocated for increasing the peat heating plant capacity to meet the heating requirements of this building. The costs for connecting the Service Building to the peat heating plant are much greater due to the lengthy distance involved for distribution sys-

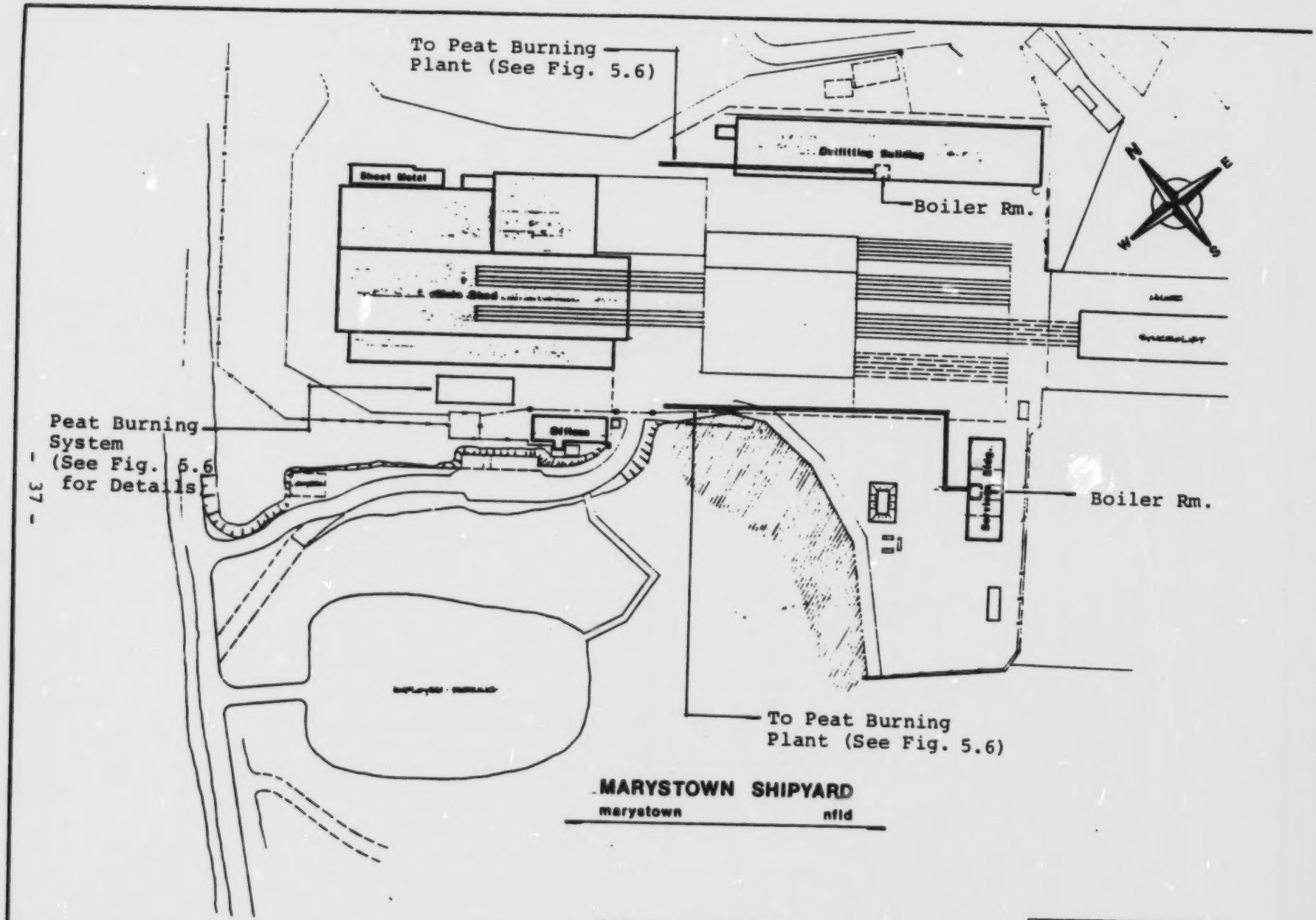
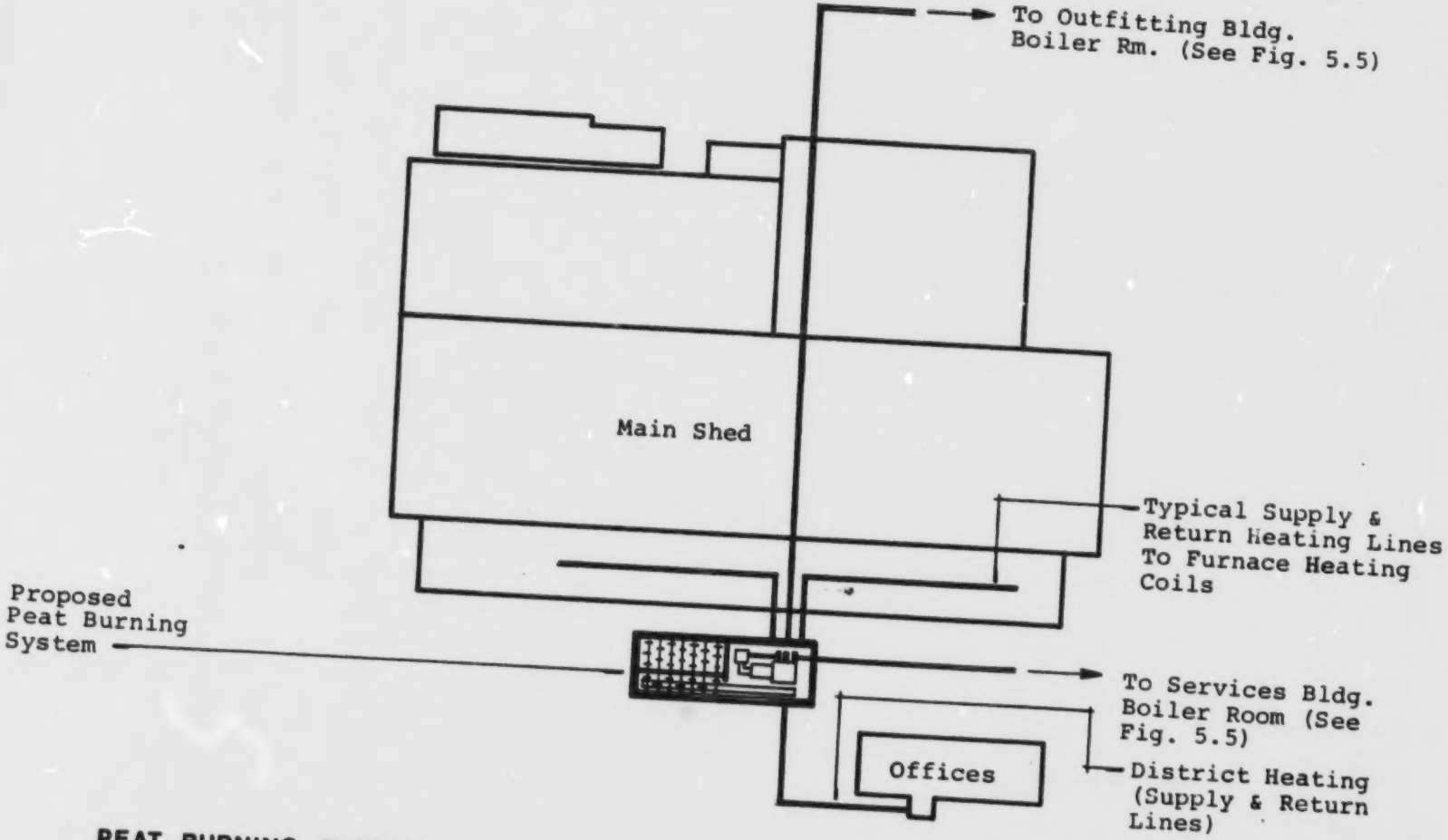

To Peat Burning Plant (See Fig. 5.6)
Boiler Rm.
Peat Burning System (See Fig. 5.6 for Details)
Boiler Rm.
To Peat Burning Plant (See Fig. 5.6)
MARYSTOWN SHIPYARD
marystown nfld

FIGURE 5.5:SITE PLAN

Scale 1:1800 (Approx.)



PEAT BURNING SYSTEM

MARYSTOWN SHIPYARD
marystown nfld

FIGURE 5.6

tem and the fact that the load is steam. This requires that the distribution system be steam and that converters be installed at the Outfitting Building and the Office Building. Section 6.0 does a life cycle costing analysis of the building versus distribution heating viability.

It is concluded as a result of the analysis in Section 6 that a peat fired heating plant system with an extensive heating distribution system is cost effective at the Marystown Shipyard. The plant should therefore incorporate distribution heating for the Outfitting, Services, and Office Buildings.

Operation of the shipyard varies with the workload which ranges from one shift of 150 people to one shift of 600 people with a second shift for several days a week.

The peat burning system should consist of a central hot water plant with heating coils installed into each of the warm air furnaces in the Main Shed. An overhead steam district heating system should be provided to additionally heat the Outfitting, Services and Office Buildings.

The heating plant load for optimum peat plant efficiency is expected to be 2,060 kW (210 BHP). A detailed breakdown of this sizing based on the heating requirements of these buildings is shown in Appendix 4.

5.4 JAMIESON ACADEMY

5.4.1 Jamieson Academy Site Inspection

There is adequate space outside of the building adjacent to the Boiler Room for the installation of a pre-assembled peat burning system. There is also adequate space inside of the boiler room for the installation of the system components.

The major drawback to this conversion is the higher cost for low capacity heating plants (ie: the ratio of capital cost to plant capacity is high) in relation to the other two facilities. Although this school is one of the largest in the area, the low savings relative to capital cost that will result may be a limitation to the financial viability (and complexity) of the installed equipment.

5.4.2 Jamieson Academy Energy Systems Review

Space heating and hot water are provided by two oil fired boilers of equivalent size. The capacity is 424 kW (43 BHP) output.

It is expected that each boiler is slightly oversized so that either is capable of meeting the design needs of the building, or the second boiler acts as a backup. Figure 5.7 presents the site plan for the school, with Figure 5.8 showing the Peat Burning System. The peat burning system should be sized to meet the design load of the building and its expected that 392 kW (40 BHP) would be adequate. A detailed breakdown is shown in Appendix 4.

The peat fired heating plant should be installed independent of the central heating plant and tied into the distribution system. This 'packaged' system approach was identified to be more cost effective from discussions with the manufacturer's agent than going with components system similar to the other two facilities.

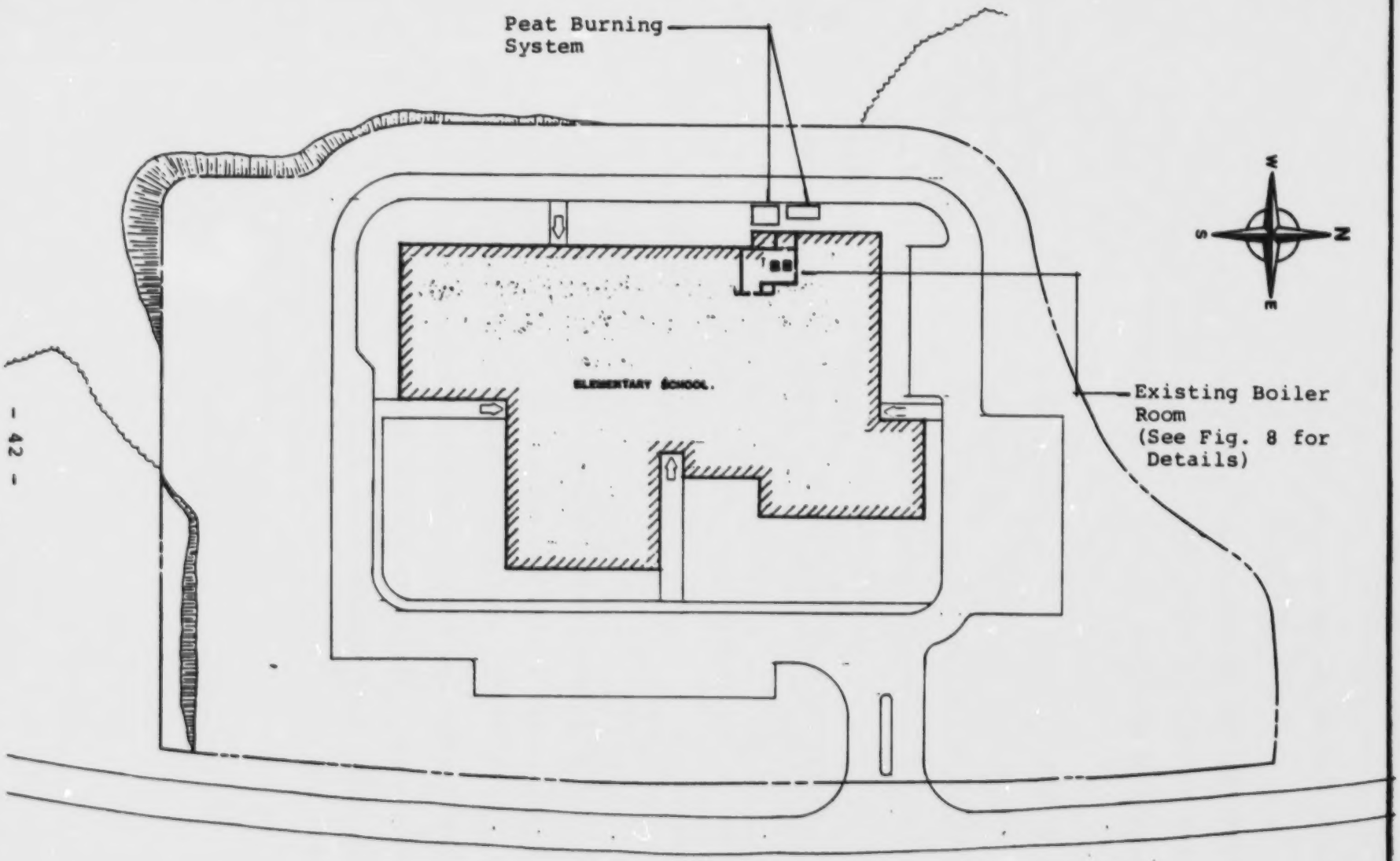
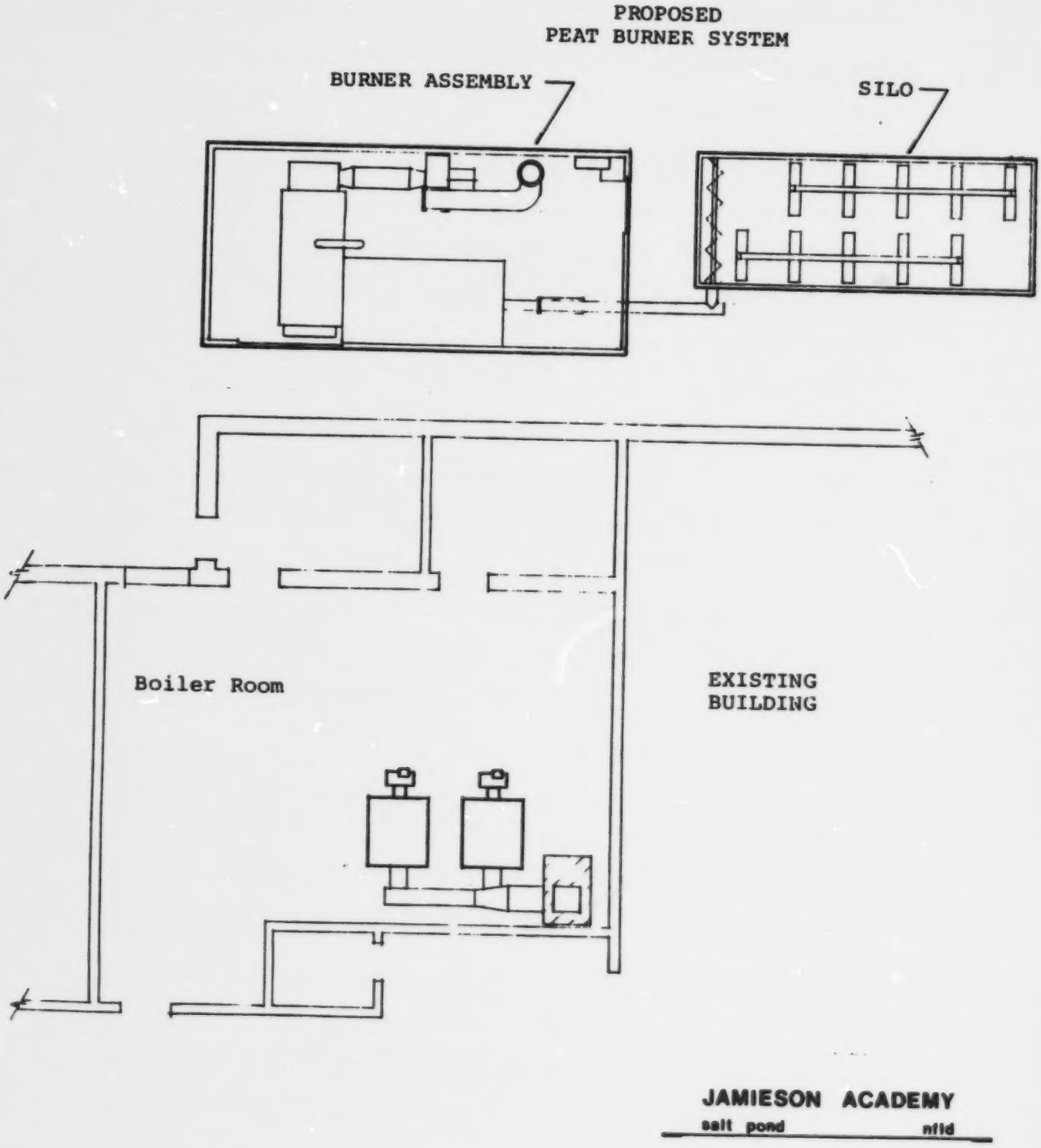


FIGURE 5.7:SITE PLAN

JAMIESON ACADEMY
salt pond nfld

Scale 1:950



PEAT BURNING SYSTEM

FIGURE 5.8

6 FINANCIAL ANALYSIS

6.1 INTRODUCTION

A financial analysis of the three facilities has been prepared to determine the preliminary feasibility potential of converting each to fuel peat. The analysis involves the life cycle costing of each fuel peat boiler plant using a financial model to identify the Net Present Value (NPV). The financial model is an in-house program designed around ASHRAE guidelines for life cycle costing.[4] The program calculates the annual cash flow resulting from a fuel peat heating plant conversion, and adjusts the cash flow by discounting the annual cash flow to base year dollars. The totalized discounted annual cash flow is the Present Value of a conversion. The NPV is the Present Value less the Capital Cost of a conversion. For a project to be viable the Net Present Value of that project must be a positive dollar value.

The analysis has been completed based on the fuel peat heating plant capital cost, annual displaceable fuel oil cost, annual fuel peat cost, and additional operating and maintenance costs resulting from the installation of the fuel peat heating plant with the fuel oil heating plant remaining in place. The results

for each facility are presented in Appendix 8. These results are expressed in Year 1991 dollars (1991$). The analysis assumes a peatfield is selected in 1987, ditching started in late 1987 or early 1988, and the heating plant construction is completed late in 1991.

6.2 FINANCIAL MODEL INPUTS AND ASSUMPTIONS

The inputs to the financial model for each fuel peat boiler plant are as follows:

a) Capital cost of the plant and ancillary requirements such as a building, engineering and management of the design and construction. The capital costs were established using standard estimating methods and in consultation with the manufacturer's agent.

b) Annual displaceable fuel oil costs resulting from using the existing oil fired boilers for peak operation only, as discussed in Section 5.

c) Annual fuel peat costs resulting from burning fuel peat in place of fuel oil, as discussed in Section 5.

d) Annual Operation and Maintenance Costs additional to the facility due to the operation of a fuel peat boiler, as discussed in Section 5.

e) Period of analysis, which is the number of years that annual cash flow resulting from the conversion is considered in the analysis, and must be not greater than the expected useful life of the peat fired heating plant; a probable plant life would be at least 25 years.

f) Discount rate, a rate to reflect the time-value or opportunity cost of money and must be by definition greater than inflation.

g) fuel oil, fuel peat, and O & M escalation factors, which are required to incorporate within the model the influence of cost escalation.

The principal assumptions used in the financial analysis are as follows:

a) The present value of all costs and savings are in 1991 dollars. The energy cost savings are the displaceable annual fuel oil costs less the annual fuel peat and O & M costs.

b) The capital costs discussed in Section 5 are FPI Fishplant, $1,370,800; Marystown Shipyard, $1,118,000; and Jamieson Academy, $280,000. The cost of district heating to the three remote buildings at the shipyard is included in the $1,118,000.

c) The cost of fuel peat delivered to the plant is $33/tonne as discussed in Section 4. This price includes the removal of the ash resulting from the burning of the fuel peat by the peat supplier. The total projected annual consumption of fuel peat at the three facilities is 9,200 tonnes.

d) An annual fuel cost saving has been calculated for each facility, and is presented in Table 6.1 in 1991$.

Table 6.1 Annual Net Fuel Cost Savings (x $,000)

Facility	Displaced Fuel Oil Cost	Fuel Peat Cost	Net Fuel Cost Savings
Jamieson Academy	50.3	19.7	30.6
FPI Fishplant	504.1	288.2	215.9
Marystown Shipyard	265.2	103.7	161.5

e) An incremental increase in the annual O & M cost due to the operation of a peat boiler in each facitity is identified in Table 6.2 in 1991$. This cost is outside of existing O & M expenditures for the oil fired boiler which will remain.

Table 6.2 Annual Incremental O & M Cost (x $,000)

Facility	Electricity	Maintenance	Total O & M
Jamieson Academy	1.1	3.1	4.2
FPI Fishplant	12.4	21.8	34.3
Marystown Shipyard	4.0	15.6	24.6

f) An average heating plant life of twenty years has been assumed. This is of shorter duration than the expected 25 year plant life.

g) An escalation factor of 4.5% for fuel oil and general inflation over the next 25 years was provided by the Department of Mines & Energy in early 1986 and includes minor adjustments for fuel oil of -5.0% in 1986 and 0.0% in 1987 (it is felt by the study team that fuel peat and O & M costs will track general inflation).

h) A discount rate of 10% was used; this was the rate used by the Provincial Government for energy project investment.

6.3 FINANCIAL MODEL OUTPUTS

The outputs of the financial modelling are presented in Appendix 8. Along with Present Value, Capital Cost and Net Present Value of the conversion, the following outputs are generated by the model:

a) Annual Net Savings over the period of analysis, and the associated annual value discounted to base year (1991) dollars,

b) Internal Rate of Return (IRR), iterative rate of return obtained by increasing the discount rate until the Net Present Value equals zero,

c) Benefit to Cost Ratio (BCR), ratio of Present Value to Capital Cost

d) Simple Payback Period (SPP), ratio of Capital Cost to Net Annual Cost Savings (for this model the annual displaceable fuel oil cost less the annual fuel peat incremental O & M costs, all in base year dollars), and

e) Real Payback Period (RPP), variation of Simple Payback Period by taking into consideration the time value of money and being calculated using the following formula;

$$RPP = \ln(1+(SPP*(A-1)/A)) / \ln(A) \quad (5)$$

where $A = \frac{1 + \text{Fuel Cost Escalation factor}}{1 + \text{Discount Rate}}$

6.4 FINANCIAL VIABILITY

The outputs of the financial analysis model for the addition of a fuel peat boiler to the existing facilities are presented in Table 6.3.

Table 6.3 Financial Analysis Results for the three Facilities

Output Item	Jamieson Academy	FPI Fishplant	Marystown Shipyard
Present Value	$321,600	$2,214,100	$1,668,300
Capital Cost	$280,400	$1,370,800	$1,117,900
Net Present Value	$ 41,200	$ 843,200	$ 550,400
IRR	11.78%	16.87%	15.99%
BCR	1.15	1.62	1.49
SPP	10.63yrs	7.55yrs	8.17yrs
RPP	15.98yrs	9.87yrs	10.95yrs

The results indicate that each facility is a viable candidate for conversion to a peat fired heating plant. The Real Payback Periods for the viable facilities are well within the life of a peat fired heating plant.

6.5 FINANCIAL SENSITIVITY AND SUMMARY

Sensitivity Analyses were completed to measure the stability of the financial viability of the FPI Fishplant and Marystown projects. The individual analysis was accomplished by modifying the value of various inputs, one at a time, to the financial model in an iterative manner until the NPV of a project reached zero. The value of the input being studied at which the NPV equals zero is referred to as the "break-even value". The ratio of the "break-even value" to the initial assumption is referred to as the

sensitivity factor for that input. The following model inputs were selected for sensitivity analysis; a) Capital Cost, b) Annual Displaceable Fuel Oil Cost, c) Annual Fuel Peat Cost,and d) Annual Incremental O & M Cost. Of course the results of the sensitivity analysis for any one input assumes that the other inputs to the financial model do not change.

Table 6.4 displays the four inputs that were modified and the associated sensitivity factors for each of the two facilities that have a positive NPV.

The results presented in Table 6.4 indicate that the two conversion can tolerate reductions in the cost of fuel oil (and potential energy cost savings) or an in-

Table 6.4 Results for Sensitivity Factors

Facility	Financial Model Inputs			
	Capital Cost	Annual Fuel Oil Cost	Annual Fuel Peat Cost	Added O & M Cost
FPI Fishplant	1.62	0.68	1.24	3.02
Marystown Shipyard	1.49	0.83	1.43	2.84
Jamieson Academy	1.15	0.89	1.17	1.80

crease in cost in either of the other three model inputs. As the inputs are not mutually exclusive, the tabulated sensitivity factors above are maximum limits

on deviations from the initial assumptions to the financial model that either project can withstand and maintain viability.

Future sensitivity analysis was completed on the impact of fuel oil price fluctuations. Five fuel oil escalation scenarios to the year 2011 were considered. The first scenario, Case 1, is equal to that used to generate the Tables in Appendix 8. Case 1 was produced in consultation with the Department of Mines and Energy. The five scenarios are listed in Table 6.5.

Generally for cases 1, 2, and 4 fuel oil escalate at 4.5% equal to general inflation; while in cases 3 and 5 fuel oil escalates at 6.0%, 1.5% ahead of general inflation. These five cases of fuel oil escalation were inputted into the financial model for each of the three facilities and the Net Present Value was recorded. The results are presented in Table 6.6.

As indicated by Table 6.6, the Marystown Shipyard and the F.P.I. Fishplant can withstand dropping fuel oil costs down in 1986 and 1987 to at least 80% of 1985 annual costs. The results of Cases 3 and 5 show that

Table 6.5 Fuel Oil Escalation Factors

YEAR	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5
1985	1.00	1.00	1.00	1.00	1.00
1986	0.95	0.90	0.90	0.80	0.80
1987	0.95	0.90	0.90	0.80	0.80
1988	0.99	0.94	0.95	0.84	0.85
1989	1.04	0.98	1.01	0.87	0.90
1990	1.08	1.03	1.07	0.91	0.95
1991	1.13	1.07	1.14	0.95	1.01
1992	1.18	1.12	1.20	1.00	1.07
1993	1.24	1.17	1.28	1.04	1.13
1994	1.29	1.22	1.35	1.09	1.20
1995	1.35	1.28	1.43	1.14	1.28
1996	1.41	1.34	1.52	1.19	1.35
1997	1.48	1.40	1.61	1.24	1.43
1998	1.54	1.46	1.71	1.30	1.52
1999	1.61	1.53	1.81	1.36	1.61
2000	1.68	1.59	1.92	1.42	1.71
2001	1.76	1.67	2.03	1.48	1.81
2002	1.84	1.74	2.16	1.55	1.92
2003	1.92	1.82	2.29	1.62	2.03
2004	2.01	1.90	2.42	1.69	2.15
2005	2.10	1.99	2.57	1.77	2.28
2006	2.19	2.08	2.72	1.85	2.42
2007	2.29	2.17	2.89	1.93	2.57
2008	2.39	2.27	3.06	2.02	2.72
2009	2.50	2.37	3.24	2.11	2.88
2010	2.61	2.48	3.44	2.20	3.06
2011	2.73	2.59	3.64	2.30	3.24

Table 6.6 Sensitivity of Projects NPV to Fuel Oil Cost Escalation (x $,000)

Facility	Case 1	Case 2	Case 3	Case 4	Case 5
Jamieson Academy	41	22	114	-18	64
FPI Fishplant	843	705	1,895	428	1,485
Marystown Shipyard	550	447	1,073	240	796

all three facilities are financially viable conversions if fuel oil escalates at a rate higher than general inflation over the life of the project. Jamieson Academy, however can not withstand a 20% drop in fuel oil costs.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

This report quantified the fuel peat resource and the potential demand for the indigenous fuel in the southern Burin Peninsula study area, and the viability of installing a fuel peat heating plant conversion for each of three facilities in the study area.

The fuel peat resource of the southern Burin Peninsula is of a high potential with mainly Blanket Bog classification which is conductive to mining of this indigenous fuel. There are 39 peatfields in the study area that are sufficiently large to allow annual production of 6,000 tonnes of fuel peat at 50% moisture content. The production goal of 20,000 tonnes annually is needed to economically produce fuel peat. There are nine peatfields that are large enough to produce this quantity of fuel peat.

The cost of fuel peat to the large user, with bulk handling abilities is $43/tonne (at 50% M.C.) when the supplier is producing 9,200 tonnes/annum and the transport distance is no greater than 15 kilometers. This assumes a discount rate of 20% for a private developer. Using a Government discount rate of 10% the

the unit cost would be $33/tonne. Large scale fuel production, at least 20,000 tonnes(at 50% M.C.), would allow the unit cost to drop to $33/tonne at the 20% discout rate.

For industrial/commercial/institutional users within the study area, who consume at least $10,000 per annum of fuel oil, there is a potential to displace a total of 5.2 million litres. This fuel oil consumption is equivalent to 20,500 tonnes (at 50% M.C. fuel peat). Including the residential sector (assuming a 50% penetration) the fuel peat equivalent consumption is 40,800 tonnes per annum (at 50% M.C.). The conversion of this consumption totally to fuel peat would support the production of two viable fuel peat mining operations. However this is unlikely that anywhere near total conversion from oil to peat would occur.

The three facilities studied; FPI Fishplant - Marystown, consumes 1.70 million litres of #6 fuel oil (Bunker 'C'), and Jamieson Academy - Salt Pond and Marystown Shipyard consume 0.62 million litres of #2 fuel oil (furnace oil). The results of the technical and financial analysis indicate that fuel peat heating plant installations are technically possible and are financially viable in retrofit situations.

It must be remembered that in new construction financial viability of peat fired plants will be greater due to the capital cost considered in the financial analysis being the differential of peat fired versus. oil fired heating plants. This is a lower capital cost in comparison to that of retrofit applications and hence a higher Net Present Value.

It is more viable to convert a heating plant that consumes #2 fuel oil versus one that consumes #6 fuel oil, assuming all other parameters are constant. It is more viable to choose a heating plant capacity sized to the base load and allow the existing plant to carry the peak load to optimize on capital cost versus fuel cost savings.

The fuel peat heating plant for the F.P.I. Fishplant Marystown, is required to be a steam boiler of 4,100 kW (419 BHP) capacity. An enclosing building is required. For the Marystown Shipyard the steam boiler capacity is 2,060 kW (210 BHP) to generate steam for a distribution system to heat the Main Shed and the Outfitting, Office and Service Buildings. Jamieson Academy fuel peat heating plant capacity is 392 kW (40 BHP). The plant is a factory assembled module that would be mounted

adjacent to the building. The three facilities would have an annual consumption of 9,200 tonnes of fuel peat.

7.2 RECOMMENDATIONS

The following represent the recommendations of this study.

a) The installation of fuel peat heating plant such that it would be commissioned in late 1991 for each of the Marystown Shipyard, the FPI Fishplant, Marystown, and the Jamieson Academy, Salt Pond be encouraged, possibly through capital cost grants.

b) The cost of fuel peat to these facilities be subsidized down to a delivered unit cost of $33 per tonne. The subsidy would initially be $87,000 per year and reduce as annual consumption increased and would be zero when annual consumption in the region meets the 20,000 tonne (50% moisture content) level. The subsidy would be $10/tonne for the 9,200 tonne annual consumption of the three facilities. An alternative subsidy option would be an initial capital grant to defray the peat field preparation costs.

c) The development of a 75 hectares peatfield in the Winterland region in 1987 - 1988 be promoted by obtaining a private developer, or by Government with a private developer assuming control once the peatfield has adequately drained. This development should be contractually tied into the heating plant installations which would produce some fuel peat in 1991 and be fully operational early in 1992.

d) The promotion of the use of fuel peat by the residential sector be encouraged, as the positive impact of this sector on unit costs of fuel peat production is high. "Family Plots" are a possible fuel peat production scheme for the residential sector.

e) The final source of the fuel peat heating plants requires further consideration as only one manufacturer, KMW, supplied detailed information and costing for the preliminary design.

f) That a steering committee be set up to oversee new construction in the area to encourage the use of fuel peat heating plants. This will promote the installation of fuel peat heating plants in new

construction because only the incremental capital cost of a peat fired heating plant versus an oil fired heating plant is considered.

g) The development of a peatfield should be preceeded by a survey of the fields of adequate size to optimize the selection so that field development costs are minimized. A drainage plan should be prepared before development begins. New field developments would be required every ten to fifteen years as the fuel in the original field is consumed.

h) Further development research is required to confirm that $33/tonne (at 50% M.C.) production cost is possible for large scale production (20,000 tonnes per annum). The development of approximately 170 hectares would be required for this level of production.

8 REFERENCES

1. ADI Limited for New Brunswick Energy Secretariat and EMR, Wood Chip Boiler Modifications, Fredericton N.B., 1982.

2. ADI Limited for New Brunswick Energy Secretariat and EMR, Students Residence Heat Supply System Conversion From Oil To Sawdust, 1985.

3. ADI Limited for New Brunswick Energy Secretariat and EMR, addition of a wood fired boiler at the University of New Brunswick.

4. ASHRAE Systems Handbook Chapter 42, Life Cycle Costing, 1984

5. CREDA, Fuel Peat in Newfoundland, 1985

6. Grant, Ireson, Engineering Economy, 1970

7. Neil and Gunter Limited, Forest Residue Wood Chip Substitution Study Phase I, 1983

8. Northland Associates Limited, St. Shott's Sod Peat Demonstration Project, 1985 report

9. ShawMont Newfoundland Limited, Wood Fired Boiler Feasibility Study Western Memorial Regional Hospital , Corner Brook, Newfoundland 1985.

10. Technopeat Inc., Feasibility Study for Sod Peat Fired Boiler Plant for Fishery Products Fishplant, Trepassey, Newfoundland, 1984.

11. Trivett, G. Michael, Determination of the Combustion Characteristics of Nfld Peat, 1983.

12. Weston Brigham Halpern, Essentials of Canadian Managerial Finance, Page 242 - 270, 1979.

13. Northland Associates Ltd., Peatland Inventories of Newfoundland 1978 - 1982.

14. Wells and Vardy, Peat Resource of Newfoundland with emphasis on its use for fuel, 1980.

15. Nova Technologies Ltd., The Bishop Fall's Fuel Peat Demonstration Project, Energy from Peat Symposium, 1983.

16. Marketing Survey of Fuel Peat.

17. Baumeister and Marks, Standard Handbook for Mechanical Engineers, Seventh Edition, 1967, pp. 7-22, 7-23.

18. Ibid, pp. 7-18, 7-19.

19.Personal Communications, R. Holmes; May, 1986.

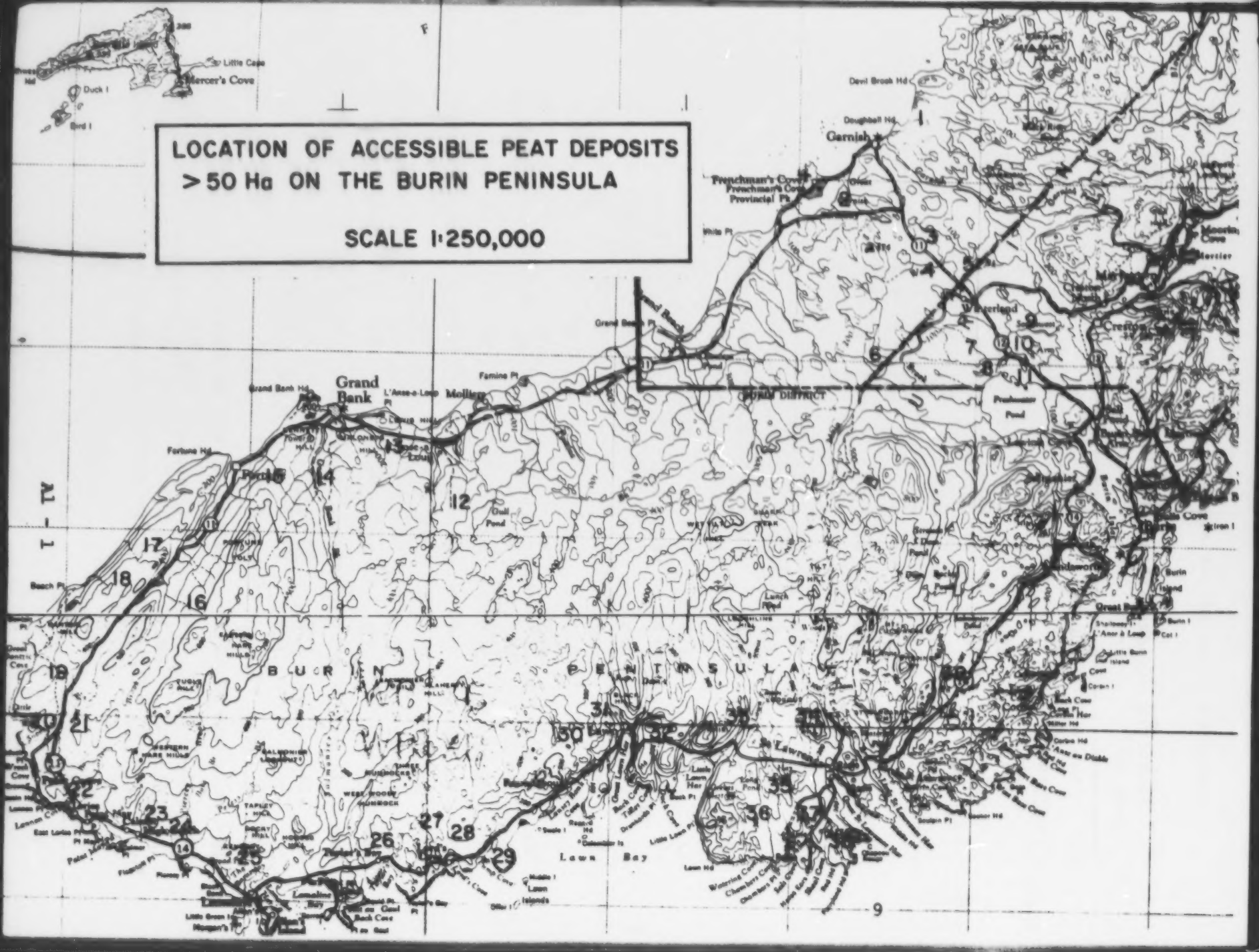
20.Personal Communications, J. Drover; June, 1986.

21.Personal Communications, E. Dawe; May, 1986.

22.Lunde, Peter J.; Life-Cycle Economics, Solar Age,September 1982, pp.57-58.

APPENDIX 1

PEAT RESOURCE MAP


LOCATION OF ACCESSIBLE PEAT DEPOSITS
>50 Ha ON THE BURIN PENINSULA
SCALE 1:250,000
Grand Bank
Garnish
Fortune
Marystown
Burin
Lawn
Lawn Bay
BURIN PENINSULA
Little Cape
Mercer's Cove
Duck I
Bird I
Devil Brook Hd
Doughball Hd
Frenchman's Cove
Provincial Pt
White Pt
Famine Pt
Grand Bank Hd
Fortune Hd
Beach Pt
Gull Pond
Lawn Hd
Lawn Islands
Creston
Mooring Cove
Iron I
Burin Island
Great Pt
Burin Cat I
Corbin Hd
Anse au Diable
Back Cove
Winter Hd
Wiseman Cove
Chambers Cove
Chambers Pt
Lawn Harbour
Little Lawn Harbour
Little Lawn Islands
Middle I
Otter I
Lawnshire
Little Green Island
Morgan's Pt
Bank Cove
Tuckers Hill
Tapley Hill
Rocky Hill
Hungry Hill
Salmonier Lookout
Northern Head Hills
West Brook
Famine Brook
Lawn Brook
Tiller Cove
Drowned Pt Cove
Little Lawn Pt
Lawn Pt
Seaton Pt
Seaton Hd
Lawn Harbour Hill
Lawn Harbour Pt
Lawn Harbour Hd
Lawn Harbour Cove
Lawn Harbour Head
Lawn Harbour Point

Inventory of Accessible* Peat Deposits on the Burin Peninsula

No.	Map #	Deposit Type	Area (Ha)	Volume m^3 Horticultural Peat	Fuel Peat
1	1M3/42	BLB	167	1,577,200	1,521,300
2	1M3/41	BLB	54	231,300	516,500
3	1M3/42	BLB	91	392,600	876,500
4	1M3/32	BLB-PF	56	61,700	347,800
5	1M3/32	BLB	179	767,600	1,713,600
6	1M3/32	BLB	99	425,700	950,400
7	1M3/32	BLB	58	248,500	554,900
8	1M3/22	BLB	360	1,549,700	3,459,800
9	1M3/32	BLB	322	1,385,500	3,093,100
10	1M3/32	BLB	162	698,300	1,559,000
11	1M3/22	BLB	127	547,400	1,222,100
12	1M4/13	BLB	3403	14,632,900	32,668,800
13	1M4/23	BLB	67	288,500	644,200
14	1M4/12	BLB	66	283,800	633,600
15	1M4/22	BLB	65	278,200	621,100
16	1M4/12	BLB	91	391,300	873,600
17	1M4/11	BLB	91	391,700	874,600
18	1M4/11	BLB	85	365,500	816,000
19	1L13/41	BLB	68	292,000	651,800
20	1L13/41	BLB	51	220,600	494,500
21	1L13/41	BLB	1514	6,510,200	14,534,400
22	1L13/31	BLB	99	424,000	946,600
23	1L13/31	BLB	80	342,300	764,200
24	1L13/32	BLB	194	834,600	1,863,400
25	1L13/32	BLB	4557	19,596,000	43,749,100
26	1L13/33	BLB	536	2,306,100	5,148,500
27	1L13/33	BLB	179	771,400	1,722,200
28	1L13/33	BLB	125	537,100	1,199,000
29	1L13/33	BLB	54	231,300	516,500
30	1L13/44	BLB	1467	6,306,400	14,079,400
31	1L13/44	BLB	109	470,000	1,049,300

Inventory of Accessible* Peat Deposits on the Burin Peninsula

No.	Map #	Deposit Type	Area (Ha)	Volume m^3 Horticultural Peat	Fuel Peat
32	1L13/34	BLB	104	445,900	995,500
33	1L14/41	PF-BLB	60	72,000	228,000
34	1L14/41	BLB	328	1,408,700	3,145,000
35	1L14/31	PF-BLB	76	91,700	290,300
36	1L14/31	BLB	139	596,800	1,332,500
37	1L14/31	BLB	78	337,100	752,600
38	1L14/31	BLB	74	316,500	706,600
39	1L14/42	BLB	58	249,400	556,800

N.B. BLB - Blanket Bog
PF - Patterned Fen

* Only deposits greater than 50 ha in size and within one km. of a road are listed.

The peat deposits shown on the accompanying map and listed in the table are all potential sites for fuel peat. These were selected based on the global inventory carried out by Northland Associates Limited in 1980. The volumes shown are only estimates. The quantities of fuel peat on the Burin Peninsula is certainly sufficient to provide the minimum demand necessary to sustain a fuel peat harvesting project (5,000 tonnes per year). It must be remembered here that before any site could be selected for development, it would be necessary to conduct detailed field surveys to select the best possible site and to confirm the quantities and quality of the peat.

APPENDIX 2

PEAT FUEL PRODUCTION

Fuel Peat Production Costs

Conventional sod peat production in Europe is widespread, particularly in Finland and Ireland. Peat is supplied as fuel to energy plants, industrial process heating and residential district heating systems. It is also used as fuel in private homes.

Recent development work in sod peat harvesting at St. Shotts indicates varying results in the small scale production of fuel peat sods. Using farm tractors and sod extruders, proven successful in Ireland, a 30 hectare site produced sufficient wet sod peat for a 1500 tonne harvest. The harvest itself, however was only partially successful, because the bog fields were not adequately drained and thus not suitable for mechanical harvesting.

It is hoped that by following bog preparation procedures as proven in Europe, efficient and economic production of sod peat will provide competitively priced alternative energy fuel for industrial and public sector users in Newfoundland.

Small scale sod peat production usually applies to bog developments in the 50 to 500 hectare range. The Burin peninsula is known to have substantial blanket bog deposits. Northland Associates completed a global inventory in 1980, and selected potential sites for this preliminary feasibility study.

Preliminary Assumptions:

1) confirmed peat blanket bog suitable for fuel peat production.

2) Peat deposits deep enough for sod peat production (min. 1.2M).

3) sod production and harvesting based upon Irish Herbst system, and performance rating as demonstrated at St. Shotts project.

4) Average sod peat yield; 65 - 75 tonnes of field dried sod peat per ha. per harvest. It is also assumed that at least 2 harvests per season are feasible.

5) Dried peat can be sold at the site immediately following production to minimize stacked losses.

Outline of Production Operation

Organization: Private Corporation, having access to working capital funding of at least $1 million.

Analysis and Startup:

Viability of the venture will be dependent upon a detailed analysis of all site selection factors, and firm commitments by energy users in the area to purchase the finished product. Preferably these potential users should take an equity position in the venture.

Schedule:

Year 1 - Detailed analysis and planning, peatfield survey, drainage plan, and preparation of the development contracts.

Year 2 - Bog Preparation, essentially executed by contract with minimum commitment to equipment purchases.

Year 3-6 - Bog Maintenance, reditching to improve drainage, surface removal and profiling.

Year 6 - Purchase or lease peat production equipment. Conduct training for work crews. Finalize supply contracts with energy users.

Year 7 - First harvest year. Estimated single full harvest and half a second harvest.

Year 8 - Reach target harvest of two full harvests per season.

Capital Program:

Development and Planning, year 1 - 7
$ 25,000. yr.
Bog Preparation, Year 2
$ 150,000.
Bog Maintenance, Years 3 - 6
$ 30,000
Purchase Production Equipment, Year 6
$ 150,000
Operating Budget during production
$ 65,000.

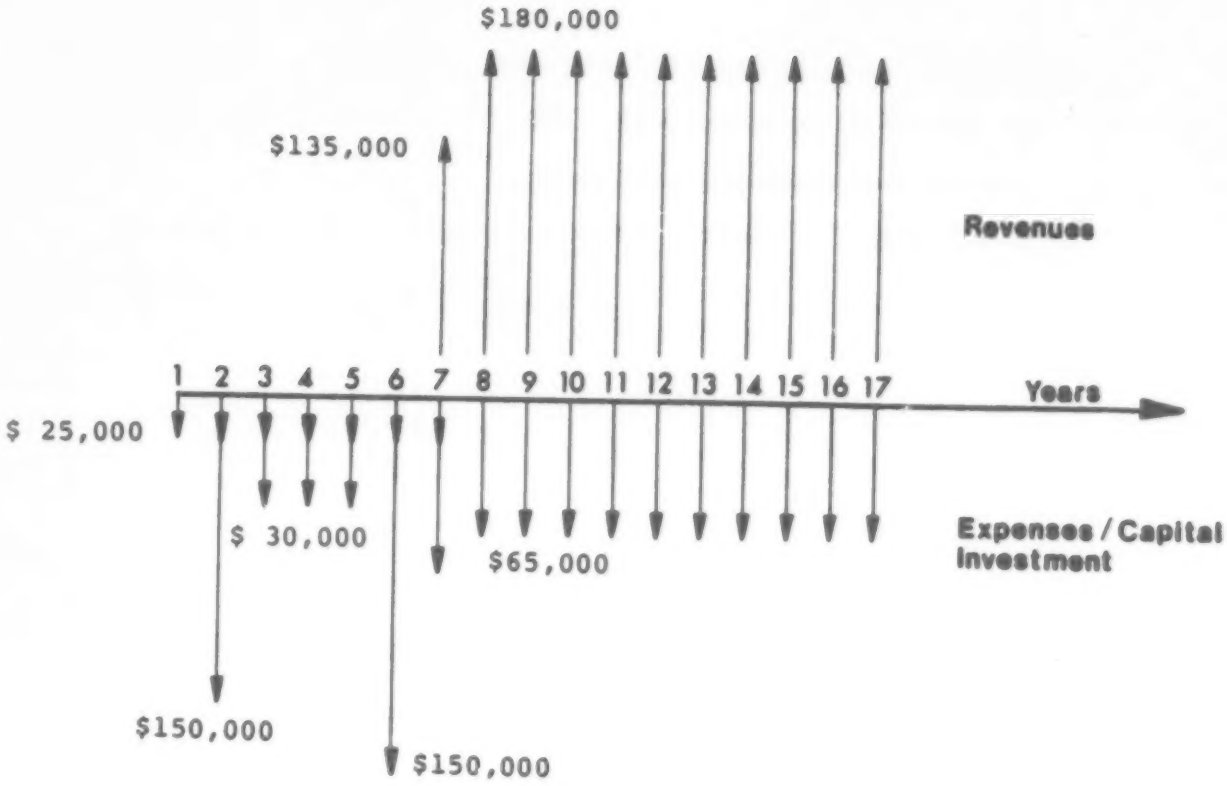
Production Schedule:

Year 7 - estimated 90 t/ha - 4,500 t.
Year 8 - estimated 120 t/ha - 6,000 t.

Estimated economic life - 10 - 15 yrs.

Preliminary Production Cost Estimate

Cash Flow Diagram: Sod Peat Production System



Discount Rate 20% (Internal Rate of Return)

Present Worth of Production Costs

PW = $25,000 (P/A, 20%, 7) + $150,000 (P/F, 20%, 1) +
$30,000 (P/A, 20%, 6-3) + $150,000 (P/F, 20%, 6) +
$65,000 (P/A, 20%, 17-7)

Preliminary Production Cost Estimate (Cont'd)

Sum of the Production Costs

$ 25,000(3.6046)	=	$ 90,115
150,000(0.8333)	=	124,995
30,000(1.2190)	=	36,570
150,000(0.3349)	=	50,235
65,000(1.1700)	=	76,050
Total		$377,965

What selling price will recover this cash flow expenditure?

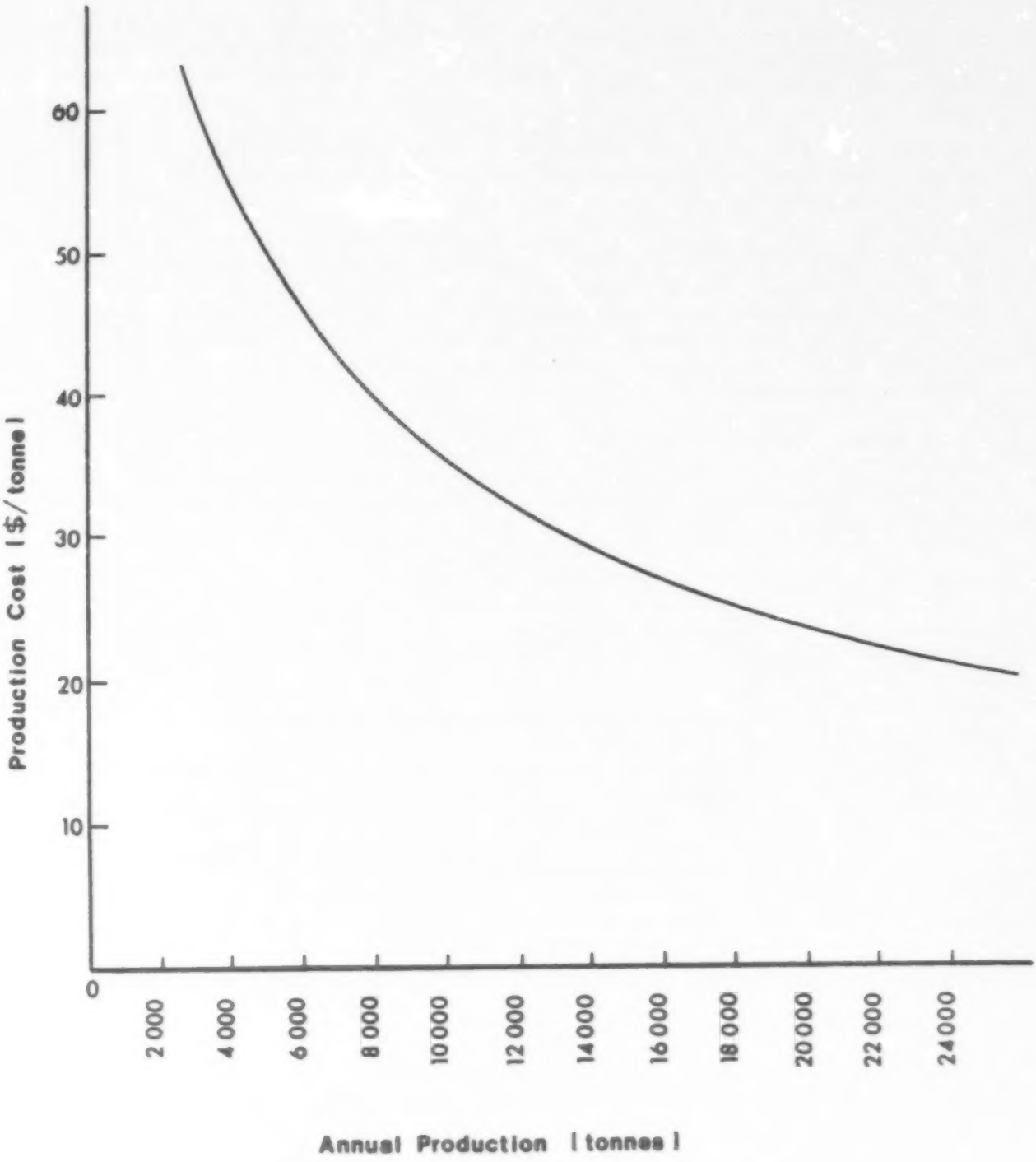
$ 377,965 = 4,500xS(P/F, 20%, 7) + 6,000xS(P/A, 20%, 17-7)

Sum of the expected Revenues

$ 377,965 = 4,500(0.2791)S + 6,000(4.7746 - 3.6096)S

$$\text{Selling Price} = \frac{377,965}{(1,256 + 7,020)} = 45.67/\text{tonne}$$

Typical Production Cost Curve



Discussion

It is very doubtful that a market can be found for fuel peat sod at this price level($45.67 per tonne). A general scaling up of the production system should result in a reduction in the unit cost.

Re-working the production costs for annual volumes of 12,000 15,000 and 25,000 tonnes gives unit costs of $32.44, $28.91, and $22.22 respectively.

Historical cost data is not yet available for fuel peat production in Newfoundland. It is generally believed that production costs may be realized in the range of $25. - $30. per tonne. This may require production volumes in excess of 20,000 tonnes per harvest season. The marketability of such a sizeable harvest will constitute a major consideration at the detailed feasibility stage.

Similarly, no real hard data are available for the handling and transporting of fuel peat. Based upon data collected for transporting wood chips elsewhere, it is suggested that transportation costs range from $4.50/tonne at distances of 20 km to $6.00/tonne at 50 km.

For the purposes of this preliminary study then, it appears reasonable to estimate the delivered price for fuel peat at between $30. and $35. per tonne. This assumes travel distances of up to 50 km, and moisture contents in the 40% - 50% range.

References: Manufacturing Cost Engineering Handbook, Edited by Eric M. Malstrom
Forest Residue Wood Chip Substitution Study, Phase 1, Neill and Gunter Limited
St. Shotts Sod Peat Demonstration Project, 1985 Report.
Northland Associates Limited - Jan. 1986

APPENDIX 3

FUEL COSTS

FUEL COSTS

APPENDIX 3

		Imperial	Metric
1.	**#6 Heavy Oil**		
	Cost - 1986 Assumed	$1.19/GAL	$0.261/l
	Heating Value	182,550 BTU/GAL	42,352kJ/l
	Estimated Seasonal Efficiency	70%	
	FUEL COST: $\frac{\$1.19 \text{ X million}}{182,550 \times 0.70}$ =	$9.31/mil BTU	$.0318/kWh
2.	**#2 Light Oil**		
	Cost - 1986 Assumed	$1.60/GAL	$.352/l
	Heating Value	168,000 BTU/GAL	38,976 kJ/l
	Estimated Seasonal Efficiency	70%	
	FUEL COSTS: $\frac{\$1.60 \times \text{million}}{168,000 \times 0.70}$ =	$13.61/mil. BTU	$.0465/kWh
3.	**Peat (Sod) @ 50% Moisture**		
	Cost - Estimate	$33/ton	
	Heating Value	4,300 BTU/lb	10,000 kJ/kg
	Estimated Seasonal Efficiency	65%	
	FUEL COST: $\frac{\$33 \times 1/2205 \times \text{million}}{4300 \times 0.65}$ =	5.35/mil. BTU	$.0183/kWh

APPENDIX 4

HEATING PLANT LOAD

HEATING PLANT LOAD

APPENDIX 4

			Imperial	Metric
1.	F.P.I. Fishplant			
1.1	Production			
	Production Hours Estimate		3,504	
	Production Fuel Consumption 2/3 x 375,000	=	250,000 GAL	1,136,500 l
	Production Consumption - Avg.		71.3 GAL/hr.	324 l/hr
	Production Steam Load:			
	$\frac{71.3 \times 182,550 \times 0.70}{1,000,000}$	=	9.11 mil. BTUH (272 BHP)	2,669 kW
1.2	Heating			
	Heating Fuel Consumption 1/3 x 375,000	=	125,000	568,250 l
	Heating Season Degree Days		8,800°F	4,900°C
	Heating Steam Load - Peak			
	$\frac{125,000 \times 182,550 \times 0.70 \times 65}{8,800 \times 24 \times 1,000,000}$	=	4.916 x mil. BTUH (147 BHP)	1,440 kW
	Heating consumption - Peak			
	$\frac{4.916 \times 1,000,000}{182,550 \times 0.70}$	=	38.5 GAL/hr	
	Heating Consumption - AVG.			
	$\frac{40°F - 7°F}{70°F - 7°F} \times 4.916 \times$ million	=	2.575 mil. BTUH (77 BHP)	754 kW
1.3	Peat Boiler Load			
	Production Load and heating Load (Peak) 272 + 147	=	419 BHP	4,110 kW
	Variance (Lowest ---> Highest) Minimum Production Load (4,672 hrs) + Heating Load (AVG)		281 BHP	2,757 kW
	Maximum Production Load (2,335 hrs) + Heating Load (Peak)		555 BHP	5,445 kW

1.3 Peat Boiler Load (Cont'd)

NOTE: Boiler #2 has an output capacity of 5,886 kW (600BHP) and can maintain full production and heating. It is felt that this Boiler is oversized relative to the peak heating and production requirements. The range of capacity for peat burning equipment could vary from 2,747 - 5,445 kW (281 - 555 BHP) but 4,110 kW (419 BHP) shall be assumed to be the optimum size for maximum peat plant efficiency and the lowest overall energy costs.

2. Marystown Shipyard		Imperial	Metric
2.1 Heating			
2.1.1 Heating (Main Shed)			
Heating Fuel Consumption	=	110,000 GAL	500,000 l
Heating Season degree days		8,800 °F	4,900 °C
Heating Load - Peak			
$\frac{110,000 \times 168,000 \times 0.70 \times 65}{8,800 \times 24 \times 1,000,000}$	=	3.98 x mil. BTUH (119 BHP)	1,166 kW
Heating Consumption - Peak			
$\frac{3.98 \times 1,000,000}{168,000 \times .70}$	=	33.8 GAL/hr	154 l/hr
2.1.2 Heating (Office)			
Heating Fuel Consumption	=	11,989 GAL	54,500 l
Heating Season degree days		8,800 °F	4,900 °C
Heating Load - Peak			
$\frac{11,989 \times 168,000 \times 0.70 \times 65}{8,800 \times 24 \times 1,000,000}$	=	.43 x mil. BTUH (13 BHP)	127 kW
Heating Consumption - Peak			
$\frac{.434 \times 1,000,000}{168,000 \times .70}$	=	3.69 GAL/hr	16.8 l/hr

2.1.3 Heating (Outfitting Bldg)		Imperial	Metric
Heating Fuel Consumption	=	28,707 GAL	130,500 l
Heating Season degree days		8,800 °F	4,900 °C
Heating Load - Peak			
$\frac{28,707 \times 168,000 \times 0.70 \times 65}{8,800 \times 24 \times 1,000,000}$	=	1.04 x mil. BTUH (31 BHP)	305 kW
Heating Consumption - Peak			
$\frac{1.04 \times 1,000,000}{168,000 \times .70}$	=	8.84 GAL/hr	40.2 l/hr

2.1.4 Heating (Service Building)			
Heating Fuel Consumption	=	15,772 GAL	71,700 l
Heating Season degree days		8,800 °F	4,900 °C
Heating Load - Peak			
$\frac{15,772 \times 168,000 \times 0.70 \times 65}{8,800 \times 24 \times 1,000,000}$	=	.57 x mil. BTUH (17 BHP)	167 kW
Heating Consumption - Peak			
$\frac{.57 \times 1,000,000}{168,000 \times .70}$	=	4.85 GAL/hr	22.0 l/hr

2.2 Peat Plant Load			
Maximum Load		6.02 x mil. BTUH (180 BHP)	1,764 kW

NOTE: The peak heating load for the Main Shed (1,166 kW) is quite low in comparison to the installed capacity of 3,955 kW. The over capacity is likely due to the large pickup requirements where the loading doors are opened. The peak load is increased to compensate for this effect and the optimum peat plant size is expected to be 2060 kW (210 BHP) (or 119 x 1.25 + 13 + 31 + 17).

3.	Jamieson Academy		Imperial	Metric
3.1	Heating			
	Heating Fuel Consumption	=	27,744 GAL	126,124 l
	Heating Season degree days		8,800 °F	4,900 °C
	Heating Load - Peak			
	$\frac{27,744 \times 168,000 \times 0.70 \times 65}{8,800 \times 24 \times 1,000,000}$	=	1.004 x mil. BTUH (30 BHP)	294 kW
	Heating Consumption - Peak			
	$\frac{1.004 \times 1,000,000}{168,000 \times .70}$	=	8.54 GAL/hr	38.8 l/hr
	Heating Boiler Size	(2)	1,446 MBTU (43 BHP)	424 kW
3.2	Peat Plant Load			
		(1)	1,339 MBTU (40 BHP)	392.4 kW

NOTE: It is estimated that a single boiler can provide full heating for the school and the second boiler acts as a backup. The peat plant is sized for approximately one boiler.

APPENDIX 5

ADDITIONAL OPERATING COSTS

ADDITIONAL OPERATING COSTS

APPENDIX 5

1. Plant Operators: Additional operators are not required.

2. Power

F.P.I. Fishplant
900 kWh/day x 270/days/year x $ .042/kWh = $10,000
Marystown Shipyard
600 kWh/day x 250/days/year x $ .042/kWh = $ 6,400
Jamieson Academy
75 kWh/day x 250/days/year x $0.045/kWh = $ 900

3. Maintenance

F.P.I. Fishplant:		$17,500
Marystown Shipyard	:	$13,300
Jamieson Academy	:	$ 2,500

APPENDIX 6

EQUIPMENT SIZING

EQUIPMENT SIZING

APPENDIX 6

1. F.P.I. Fishplant:
Peat Boiler sized to meet maximum load during production, or 70% of Boiler #2.

		Imperial	Metric
1.1 Peat Feed System			
- Maximum Peat Required (100% Load)			
$\frac{140,027,430 \text{ BTUH}}{4,300 \times .825 \times 2,240}$	=	1.765 Ton/hr	1.79 Tonne/hr
- Maximum Conveying Rate			
$\frac{2.174 \times 1,000}{400}$	=		5.43 M^3/hr.
Design @ 200%	=	385 FT^3/hr	10.86 M^3/hr.
1.2 Peat Storage Bin			
- Assume 3 days (16 hr/day) storage at maximum Feed			
3 x 16 x 5.43	=	9182 FT^3	260 M^3

2. Marystown Shipyard:
Peat Burning System sized to meet maximum expected average load during production.

2.1 Peat Feed System			
- Maximum Peat Required (100% Load)			
$\frac{7,035,000 \text{ BTUH}}{4,300 \times .825 \times 2,240}$	=	.89 Ton/hr	.90 Tonne/hr
- Maximum Conveying Rate			
$\frac{.91 \times 1,000}{400}$	=		2.27 M^3/hr
- Design @ 200% rate	=	158.6 FT^3/hr	4.49 M^3/hr
2.2 Peat Storage Bin			
- Assume 3 days (16 hr/day) storage at maximum feed			
3 x 16 x 2.27	=	3,849 FT^3	109.0 M^3

	Imperial	Metric

3. **Jamieson Academy:**
Peat boiler sized to match one boiler.

3.1 Peat Feed System

- Maximum Peat Required (100 % Load)

$$\frac{1{,}339{,}000 \text{ BTUH}}{4{,}300 \times .825 \times 2{,}240} = .169 \text{ Ton/hr} \quad .17 \text{ Tonne/hr}$$

- Maximum Conveying rate

$$\frac{.17 \times 1{,}000}{400} = .428 \text{ M3/hr}$$

Design @ 200% rate = 30.4 FT3/hr .86 M3/hr

3.2 Peat Storage Bin

- Assume 3 days (16 hr/day) Storage at maximum feed

$3 \times 16 \times .428$ = 724 FT3 20.5 M3

APPENDIX 7

ANNUAL ENERGY SAVINGS

ANNUAL ENERGY SAVINGS

APPENDIX 7

1. F.P.I. Fishplant:

Present:	Energy cost 1,704,750 L $ 0.261/L	=	$444,940
Future:	Energy Cost (Oil) 5% x $444,940	=	- $ 22,247
	Energy Cost (Peat @ 50%) 95% x 444,940 x 5.35/9.31	=	- $242,901
	Operating Costs $10,000 - Power $17,500 - Maintenance	=	- $ 27,500
ANNUAL SAVINGS			$152,292 (34%)

2. Marystown Shipyard:

Present:	Energy Cost 756,700 $ .352/L	=	$266,358
Future:	Energy Cost (Oil) 18% x 266,358	=	- $ 47,944
	Energy Cost (Peat @ 50%) 82% x 266,358 x 5.35/13.61	=	- $ 85,857
	Operating Costs $ 6,400 - Power $ 13,300 - Maintenance	=	- $ 19,700
ANNUAL SAVINGS			$112,857 (42%)

3. Jamieson Academy:

Present:	Energy Cost 126,125 L $ .352/L	=	$ 44,396
Future:	Energy Cost (Oil) 5% x 44,396	=	- $ 2,220
	Energy Cost (Peat @ 50%) 95% x 44,396 x 5.35/13.61	=	- $ 16,579
	Operating Costs $ 900 - Power $ 2,500 - Maintenance	=	- $ 3,400
ANNUAL SAVINGS			$ 22,309 (50%)

APPENDIX 8

LIFE CYCLE COST ANALYSIS

LIFE CYCLE COST ANALYSIS
Provincial Consultants Limited

Fuel Peat Boiler Addition - Jamieson Academy, Salt Pond

INPUT PARAMETERS

Capital Cost of Peat Boiler in 1991$	$280,390.94
Displaceable Annual Fuel Oil Cost in 1991$	$50,295.90
Annual Fuel Peat Cost in 1991$	$19,677.52
Annual Incremental O & M Costs in 1991$	$4,237.02
Discount Rate	10.00%
Fuel Oil Cost Escalation Factor	4.50%
Fuel Peat and O & M Cost Escalation Factor	4.50%
Project Life (period of analysis in years)	20
Ratio of Fuel Escalation to Discount Rate	.95

YEAR NO.	YEAR	FUEL OIL COST	FUEL PEAT COST	FUEL SAVINGS	O & M COSTS	ANNUAL CASH FLOW	ANNUAL DISCOUNTED CASH FLOW	CUMULATIVE CASH FLOW PRESENT VALUE	CUMULATIVE CASH FLOW NET P.V.
1	1992	-52559	-20563	31996	-4428	27569	25062	$25,062.29	($267,946.24)
2	1993	-54924	-21488	33436	-4627	28809	23809	$48,871.47	($244,137.06)
3	1994	-57396	-22455	34941	-4835	30106	22619	$71,490.19	($221,518.34)
4	1995	-59979	-23466	36513	-5053	31460	21488	$92,977.97	($200,030.56)
5	1996	-62678	-24522	38156	-5280	32876	20413	$113,391.37	($179,617.16)
6	1997	-65498	-25625	39873	-5518	34355	19393	$132,784.09	($160,224.44)
7	1998	-68446	-26778	41667	-5766	35901	18423	$151,207.18	($141,801.35)
8	1999	-71526	-27983	43542	-6025	37517	17502	$168,709.11	($124,299.42)
9	2000	-74744	-29243	45502	-6297	39203	16627	$185,335.95	($107,672.58)
10	2001	-78108	-30559	47549	-6580	40969	15795	$201,131.44	($91,877.09)
11	2002	-81623	-31934	49689	-6876	42813	15006	$216,137.16	($76,871.37)
12	2003	-85296	-33371	51925	-7185	44740	14255	$230,392.60	($62,615.93)
13	2004	-89134	-34872	54262	-7509	46753	13543	$243,935.26	($49,073.27)
14	2005	-93145	-36442	56704	-7847	48857	12866	$256,800.79	($36,207.74)
15	2006	-97337	-38082	59255	-8200	51055	12222	$269,023.04	($23,985.49)
16	2007	-101717	-39795	61922	-8569	53353	11611	$280,634.18	($12,374.35)
17	2008	-106294	-41586	64708	-8954	55754	11031	$291,664.76	($1,343.76)
18	2009	-111077	-43457	67620	-9357	58263	10479	$302,143.82	$9,135.29
19	2010	-116076	-45413	70663	-9778	60884	9955	$312,098.92	$19,090.39
20	2011	-121299	-47457	73843	-10218	63624	9457	$321,556.27	$28,547.74

Cash Flow PRESENT VALUE (1991$)	$321,556.27
Heating Plant CAPITAL COST (1991$)	$280,390.94
NET PRESENT VALUE (1991$)	$41,165.33
Internal Rate of Return	11.78%
Benefit to Cost Ratio	1.15
Simple Payback Period (Yrs)	10.63
Real Payback Period (Yrs)	15.98

LIFE CYCLE COST ANALYSIS
Provincial Consultants Limited

Fuel Peat Boiler Addition - FPI Fishplant, Marystown

INPUT PARAMETERS

Capital Cost of Peat Boiler in 1991$	$1,370,800.13
Displaceable Annual Fuel Oil Cost in 1991$	$504,068.98
Annual Fuel Peat Cost in 1991$	$288,151.70
Annual Incremental O & M Costs in 1991$	$34,270.00
Discount Rate	10.00%
Fuel Oil Cost Escalation Factor	4.50%
Fuel Peat and O & M Cost Escalation Factor	4.50%
Project Life (period of analysis in years)	20
Ratio of Fuel Escalation to Discount Rate	.95

YEAR NO.	YEAR	FUEL OIL COST	FUEL PEAT COST	FUEL SAVINGS	O & M COSTS	ANNUAL CASH FLOW	ANNUAL DISCOUNTED CASH FLOW	CUMULATIVE CASH FLOW PRESENT VALUE	CUMULATIVE CASH FLOW NET P.V.
1	1992	-526752	-301119	225634	-35812	189821	172565	$172,564.91	($1,198,235.22)
2	1993	-550456	-314669	235787	-37424	198363	163937	$336,501.58	($1,034,298.55)
3	1994	-575226	-328829	246397	-39108	207290	155740	$492,241.41	($878,558.72)
4	1995	-601112	-343626	257485	-40868	216618	147953	$640,194.25	($730,605.88)
5	1996	-628162	-359089	269072	-42707	226366	140555	$780,749.45	($590,050.68)
6	1997	-656429	-375248	281180	-44628	236552	133527	$914,276.89	($456,523.24)
7	1998	-685968	-392135	293834	-46637	247197	126851	$1,041,127.95	($329,672.18)
8	1999	-716837	-409781	307056	-48735	258321	120509	$1,161,636.47	($209,163.66)
9	2000	-749094	-428221	320874	-50928	269945	114483	$1,276,119.56	($94,680.58)
10	2001	-782804	-447491	335313	-53220	282093	108759	$1,384,878.49	$14,078.36
11	2002	-818030	-467628	350402	-55615	294787	103321	$1,488,199.48	$117,399.34
12	2003	-854841	-488671	366170	-58118	308052	98155	$1,586,354.41	$215,554.28
13	2004	-893309	-510661	382648	-60733	321915	93247	$1,679,601.60	$308,801.47
14	2005	-933508	-533641	399867	-63466	336401	88585	$1,768,186.43	$397,386.30
15	2006	-975516	-557655	417861	-66322	351539	84156	$1,852,342.02	$481,541.89
16	2007	-1019414	-582749	436665	-69307	367358	79948	$1,932,289.83	$561,489.70
17	2008	-1065288	-608973	456315	-72425	383889	75950	$2,008,240.25	$637,440.12
18	2009	-1113226	-636377	476849	-75685	401164	72153	$2,080,393.15	$709,593.02
19	2010	-1163321	-665014	498307	-79090	419217	68545	$2,148,938.41	$778,138.27
20	2011	-1215670	-694940	520731	-82649	438081	65118	$2,214,056.40	$843,256.27

Cash Flow PRESENT VALUE (1991$)	$2,214,056.40
Heating Plant CAPITAL COST (1991$)	$1,370,800.13
NET PRESENT VALUE (1991$)	$843,256.27
Internal Rate of Return	16.87%
Benefit to Cost Ratio	1.62
Simple Payback Period (Yrs)	7.55
Real Payback Period (Yrs)	9.87

LIFE CYCLE COST ANALYSIS
Provincial Consultants Limited

Fuel Peat Boiler Addition - Marystown Shipyard - Main Shed

INPUT PARAMETERS

Capital Cost of Peat Boiler in 1991$	$747,709.16
Displaceable Annual Fuel Oil Cost in 1991$	$157,412.46
Annual Fuel Peat Cost in 1991$	$61,585.28
Annual Incremental O & M Costs in 1991$	$12,087.96
Discount Rate	10.00%
Fuel Oil Cost Escalation Factor	4.50%
Fuel Peat and O & M Cost Escalation Factor	4.50%
Project Life (period of analysis in years)	20
Ratio of Fuel Escalation to Discount Rate	.95

YEAR NO.	YEAR	FUEL OIL COST	FUEL PEAT COST	FUEL SAVINGS	O & M COSTS	ANNUAL CASH FLOW	ANNUAL DISCOUNTED CASH FLOW	CUMULATIVE CASH FLOW PRESENT VALUE	CUMULATIVE CASH FLOW NET P.V.
1	1992	-164496	-64357	100139	-12632	87507	79552	$79,552.25	($668,156.91)
2	1993	-171898	-67253	104646	-13200	91445	75575	$155,126.88	($592,582.28)
3	1994	-179634	-70279	109355	-13794	95560	71796	$226,922.79	($520,786.38)
4	1995	-187717	-73442	114276	-14415	99861	68206	$295,128.90	($452,580.27)
5	1996	-196165	-76746	119418	-15064	104354	64796	$359,924.70	($387,784.46)
6	1997	-204992	-80200	124792	-15742	109050	61556	$421,480.71	($326,228.45)
7	1998	-214217	-83809	130408	-16450	113957	58478	$479,958.92	($267,750.24)
8	1999	-223856	-87580	136276	-17190	119086	55554	$535,513.22	($212,195.94)
9	2000	-233930	-91522	142408	-17964	124444	52777	$588,289.81	($159,419.35)
10	2001	-244457	-95640	148817	-18772	130044	50138	$638,427.57	($109,281.59)
11	2002	-255457	-99944	155513	-19617	135896	47631	$686,058.44	($61,650.72)
12	2003	-266953	-104441	162512	-20500	142012	45249	$731,307.76	($16,401.40)
13	2004	-278966	-109141	169825	-21422	148402	42987	$774,294.62	$26,585.46
14	2005	-291519	-114053	177467	-22386	155080	40838	$815,132.14	$67,422.98
15	2006	-304638	-119185	185453	-23394	162059	38796	$853,927.78	$106,218.62
16	2007	-318346	-124548	193798	-24446	169352	36856	$890,783.64	$143,074.48
17	2008	-332672	-130153	202519	-25546	176973	35013	$925,796.71	$178,087.54
18	2009	-347642	-136010	211632	-26696	184936	33262	$959,059.12	$211,349.96
19	2010	-363286	-142130	221156	-27897	193258	31599	$990,658.41	$242,949.25
20	2011	-379634	-148526	231108	-29153	201955	30019	$1,020,677.74	$272,968.57

Cash Flow PRESENT VALUE (1991$)	$1,020,677.74
Heating Plant CAPITAL COST (1991$)	$747,709.16
NET PRESENT VALUE (1991$)	$272,968.57
Internal Rate of Return	14.24%
Benefit to Cost Ratio	1.37
Simple Payback Period (Yrs)	8.93
Real Payback Period (Yrs)	12.38

LIFE CYCLE COST ANALYSIS
Provincial Consultants Limited

Fuel Peat Boiler Addition - Marystown Shipyard - Main Shed
with the Outfitting Building

INPUT PARAMETERS

Capital Cost of Peat Boiler in 1991$	$934,636.45
Displaceable Annual Fuel Oil Cost in 1991$	$212,191.99
Annual Fuel Peat Cost in 1991$	$83,016.96
Annual Incremental O & M Costs in 1991$	$12,087.96
Discount Rate	10.00%
Fuel Oil Cost Escalation Factor	4.50%
Fuel Peat and O & M Cost Escalation Factor	4.50%
Project Life (period of analysis in years)	20
Ratio of Fuel Escalation to Discount Rate	.95

YEAR NO.	YEAR	FUEL OIL COST	FUEL PEAT COST	FUEL SAVINGS	O & M COSTS	ANNUAL CASH FLOW	ANNUAL DISCOUNTED CASH FLOW	CUMULATIVE CASH FLOW PRESENT VALUE	CUMULATIVE CASH FLOW NET P.V.
1	1992	-221741	-86753	134988	-12632	122356	111233	$111,232.71	($823,403.74)
2	1993	-231719	-90657	141062	-13200	127862	105671	$216,903.79	($717,732.67)
3	1994	-242146	-94736	147410	-13794	133616	100388	$317,291.31	($617,345.14)
4	1995	-253043	-98999	154044	-14415	139629	95368	$412,659.45	($521,977.00)
5	1996	-264430	-103454	160976	-15064	145912	90600	$503,259.19	($431,377.26)
6	1997	-276329	-108110	168219	-15742	152478	86070	$589,328.94	($345,307.51)
7	1998	-288764	-112975	175789	-16450	159339	81766	$671,095.21	($263,541.25)
8	1999	-301758	-118058	183700	-17190	166510	77678	$748,773.16	($185,863.29)
9	2000	-315337	-123371	191966	-17964	174003	73794	$822,567.21	($112,069.24)
10	2001	-329528	-128923	200605	-18772	181833	70104	$892,671.56	($41,964.89)
11	2002	-344356	-134724	209632	-19617	190015	66599	$959,270.70	$24,634.24
12	2003	-359852	-140787	219066	-20500	198566	63269	$1,022,539.87	$87,903.42
13	2004	-376046	-147122	228923	-21422	207501	60106	$1,082,645.59	$148,009.14
14	2005	-392968	-153743	239225	-22386	216839	57100	$1,139,746.02	$205,109.57
15	2006	-410651	-160661	249990	-23394	226597	54245	$1,193,991.43	$259,354.98
16	2007	-429131	-167891	261240	-24446	236793	51533	$1,245,524.57	$310,888.12
17	2008	-448442	-175446	272996	-25546	247449	48956	$1,294,481.05	$359,844.60
18	2009	-468622	-183341	285280	-26696	258584	46509	$1,340,989.71	$406,353.26
19	2010	-489709	-191592	298118	-27897	270221	44183	$1,385,172.94	$450,536.48
20	2011	-511746	-200213	311533	-29153	282381	41974	$1,427,147.00	$492,510.55

Cash Flow PRESENT VALUE (1991$)	$1,427,147.00
Heating Plant CAPITAL COST (1991$)	$934,636.45
NET PRESENT VALUE (1991$)	$492,510.55
Internal Rate of Return	15.96%
Benefit to Cost Ratio	1.53
Simple Payback Period (Yrs)	7.98
Real Payback Period (Yrs)	10.62

LIFE CYCLE COST ANALYSIS
Provincial Consultants Limited

Fuel Peat Boiler Addition - Marystown Shipyard - Main Shed
with the Office Building

INPUT PARAMETERS

Capital Cost of Peat Boiler in 1991$	$793,194.80
Displaceable Annual Fuel Oil Cost in 1991$	$180,289.73
Annual Fuel Peat Cost in 1991$	$70,535.68
Annual Incremental O & M Costs in 1991$	$12,087.96
Discount Rate	10.00%
Fuel Oil Cost Escalation Factor	4.50%
Fuel Peat and O & M Cost Escalation Factor	4.50%
Project Life (period of analysis in years)	20
Ratio of Fuel Escalation to Discount Rate	.95

YEAR NO.	YEAR	FUEL OIL COST	FUEL PEAT COST	FUEL SAVINGS	O & M COSTS	ANNUAL CASH FLOW	ANNUAL DISCOUNTED CASH FLOW	CUMULATIVE CASH FLOW PRESENT VALUE	CUMULATIVE CASH FLOW NET P.V.
1	1992	-188403	-73710	114693	-12632	102061	92783	$92,782.79	($700,412.02)
2	1993	-196881	-77027	119854	-13200	106654	88144	$180,926.43	($612,268.37)
3	1994	-205741	-80493	125248	-13794	111453	83736	$264,662.90	($528,531.91)
4	1995	-214999	-84115	130884	-14415	116469	79550	$344,212.54	($448,982.26)
5	1996	-224674	-87900	136774	-15064	121710	75572	$419,784.70	($373,410.11)
6	1997	-234784	-91856	142928	-15742	127187	71794	$491,578.25	($301,616.55)
7	1998	-245349	-95989	149360	-16450	132910	68204	$559,782.12	($233,412.68)
8	1999	-256390	-100309	156081	-17190	138891	64794	$624,575.80	($168,619.00)
9	2000	-267928	-104823	163105	-17964	145141	61554	$686,129.80	($107,065.00)
10	2001	-279984	-109540	170445	-18772	151672	58476	$744,606.09	($48,588.71)
11	2002	-292584	-114469	178115	-19617	158498	55552	$800,158.58	$6,963.77
12	2003	-305750	-119620	186130	-20500	165630	52775	$852,933.43	$59,738.63
13	2004	-319509	-125003	194506	-21422	173083	50136	$903,069.55	$109,874.74
14	2005	-333887	-130628	203258	-22386	180872	47629	$950,698.86	$157,504.05
15	2006	-348912	-136506	212405	-23394	189011	45248	$995,946.70	$202,751.90
16	2007	-364613	-142649	221963	-24446	197517	42985	$1,038,932.15	$245,737.35
17	2008	-381020	-149068	231952	-25546	206405	40836	$1,079,768.33	$286,573.53
18	2009	-398166	-155777	242390	-26696	215693	38794	$1,118,562.70	$325,367.90
19	2010	-416084	-162786	253297	-27897	225400	36855	$1,155,417.35	$362,222.55
20	2011	-434807	-170112	264695	-29153	235543	35012	$1,190,429.27	$397,234.47

Cash Flow PRESENT VALUE (1991$)	$1,190,429.27
Heating Plant CAPITAL COST (1991$)	$793,194.80
NET PRESENT VALUE (1991$)	$397,234.47
Internal Rate of Return	15.68%
Benefit to Cost Ratio	1.50
Simple Payback Period (Yrs)	8.12
Real Payback Period (Yrs)	10.87

LIFE CYCLE COST ANALYSIS
Provincial Consultants Limited

Fuel Peat Boiler Addition - Marystown Shipyard - Main Shed
with the Service Building

INPUT PARAMETERS

Capital Cost of Peat Boiler in 1991$	$885,536.88
Displaceable Annual Fuel Oil Cost in 1991$	$187,509.72
Annual Fuel Peat Cost in 1991$	$73,360.39
Annual Incremental O & M Costs in 1991$	$12,087.96
Discount Rate	10.00%
Fuel Oil Cost Escalation Factor	4.50%
Fuel Peat and O & M Cost Escalation Factor	4.50%
Project Life (period of analysis in years)	20
Ratio of Fuel Escalation to Discount Rate	.95

YEAR NO.	YEAR	FUEL OIL COST	FUEL PEAT COST	FUEL SAVINGS	O & M COSTS	ANNUAL CASH FLOW	ANNUAL DISCOUNTED CASH FLOW	CUMULATIVE CASH FLOW PRESENT VALUE	CUMULATIVE CASH FLOW NET P.V.
1	1992	-195948	-76662	119286	-12632	106654	96958	$96,958.30	($788,578.59)
2	1993	-204765	-80111	124654	-13200	111454	92110	$189,068.68	($696,468.21)
3	1994	-213980	-83716	130263	-13794	116469	87505	$276,573.54	($608,963.35)
4	1995	-223609	-87484	136125	-14415	121710	83130	$359,703.16	($525,833.73)
5	1996	-233671	-91420	142251	-15064	127187	78973	$438,676.29	($446,860.59)
6	1997	-244186	-95534	148652	-15742	132910	75024	$513,700.77	($371,836.11)
7	1998	-255175	-99833	155341	-16450	138891	71273	$584,974.03	($300,562.85)
8	1999	-266658	-104326	162332	-17190	145142	67710	$652,683.63	($232,853.26)
9	2000	-278657	-109021	169637	-17964	151673	64324	$717,007.74	($168,529.15)
10	2001	-291197	-113926	177270	-18772	158498	61108	$778,115.65	($107,421.24)
11	2002	-304301	-119053	185248	-19617	165631	58053	$836,168.16	($49,368.72)
12	2003	-317994	-124411	193584	-20500	173084	55150	$891,318.05	$5,781.16
13	2004	-332304	-130009	202295	-21422	180873	52392	$943,710.44	$58,173.56
14	2005	-347258	-135859	211398	-22386	189012	49773	$993,483.21	$107,946.33
15	2006	-362884	-141973	220911	-23394	197518	47284	$1,040,767.35	$155,230.46
16	2007	-379214	-148362	230852	-24446	206406	44920	$1,085,687.28	$200,150.39
17	2008	-396279	-155038	241241	-25546	215694	42674	$1,128,361.21	$242,824.32
18	2009	-414111	-162015	252096	-26696	225400	40540	$1,168,901.44	$283,364.56
19	2010	-432746	-169306	263441	-27897	235543	38513	$1,207,414.67	$321,877.78
20	2011	-452220	-176924	275296	-29153	246143	36588	$1,244,002.23	$358,465.34

Cash Flow PRESENT VALUE (1991$)	$1,244,002.23
Heating Plant CAPITAL COST (1991$)	$885,536.88
NET PRESENT VALUE (1991$)	$358,465.34
Internal Rate of Return	14.66%
Benefit to Cost Ratio	1.40
Simple Payback Period (Yrs)	8.68
Real Payback Period (Yrs)	11.89

LIFE CYCLE COST ANALYSIS
Provincial Consultants Limited

Fuel Peat Boiler Addition - Marystown Shipyard - Main Shed
with the Outfitting, Office and Service Buildings

INPUT PARAMETERS

Capital Cost of Peat Boiler in 1991$	$1,117,949.82
Displaceable Annual Fuel Oil Cost in 1991$	$265,166.53
Annual Fuel Peat Cost in 1991$	$103,742.46
Annual Incremental O & M Costs in 1991$	$24,549.78
Discount Rate	10.00%
Fuel Oil Cost Escalation Factor	4.50%
Fuel Peat and O & M Cost Escalation Factor	4.50%
Project Life (period of analysis in years)	20
Ratio of Fuel Escalation to Discount Rate	.95

YEAR NO.	YEAR	FUEL OIL COST	FUEL PEAT COST	FUEL SAVINGS	O & M COSTS	ANNUAL CASH FLOW	ANNUAL DISCOUNTED CASH FLOW	CUMULATIVE CASH FLOW PRESENT VALUE	CUMULATIVE CASH FLOW NET P.V.
1	1992	-277099	-108411	168688	-25655	143034	130031	$130,030.57	($987,919.25)
2	1993	-289568	-113289	176279	-26809	149470	123529	$253,559.61	($864,390.21)
3	1994	-302599	-118387	184212	-28015	156196	117353	$370,912.20	($747,037.62)
4	1995	-316216	-123715	192501	-29276	163225	111485	$482,397.16	($635,552.66)
5	1996	-330446	-129282	201164	-30593	170570	105911	$588,307.87	($529,641.95)
6	1997	-345316	-135100	210216	-31970	178246	100615	$688,923.04	($429,026.77)
7	1998	-360855	-141179	219676	-33409	186267	95584	$784,507.46	($333,442.36)
8	1999	-377093	-147532	229561	-34912	194649	90805	$875,312.66	($242,637.16)
9	2000	-394063	-154171	239892	-36483	203408	86265	$961,577.59	($156,372.23)
10	2001	-411796	-161109	250687	-38125	212562	81952	$1,043,529.28	($74,420.54)
11	2002	-430326	-168359	261968	-39841	222127	77854	$1,121,383.39	$3,433.57
12	2003	-449691	-175935	273756	-41634	232123	73961	$1,195,344.78	$77,394.97
13	2004	-469927	-183852	286075	-43507	242568	70263	$1,265,608.11	$147,658.30
14	2005	-491074	-192125	298948	-45465	253484	66750	$1,332,358.28	$214,408.46
15	2006	-513172	-200771	312401	-47511	264890	63413	$1,395,770.93	$277,821.12
16	2007	-536265	-209806	326459	-49649	276810	60242	$1,456,012.95	$338,063.14
17	2008	-560397	-219247	341150	-51883	289267	57230	$1,513,242.88	$395,293.06
18	2009	-585615	-229113	356502	-54218	302284	54368	$1,567,611.30	$449,661.48
19	2010	-611967	-239423	372544	-56657	315887	51650	$1,619,261.30	$501,311.49
20	2011	-639506	-250197	389309	-59207	330102	49068	$1,668,328.81	$550,378.99

Cash Flow PRESENT VALUE (1991$)	$1,668,328.81
Heating Plant CAPITAL COST (1991$)	$1,117,949.82
NET PRESENT VALUE (1991$)	$550,378.99
Internal Rate of Return	15.99%
Benefit to Cost Ratio	1.49
Simple Payback Period (Yrs)	8.17
Real Payback Period (Yrs)	10.95

APPENDIX 9

GLOSSARY

Abbreviations, and Conversion Factors

GLOSSARY: Abbreviations, and Conversion Factors

ABBREVIATIONS

BHP	-	Boiler Horse Power
BTU	-	British Thermal Unit
BTUH	-	British Thermal Unit per Hour
ft3	-	Cubic Feet
GAL	-	Gallons
Gph	-	Gallons per Hour
ha	-	hectare
hr	-	Hour
HW	-	Hot Water
kg	-	kilogram
kJ	-	kilojoule
kPa	-	kilopascals
kW	-	kilowatt
kWh	-	kilowatt-Hour
l	-	litre
m^3	-	Cubic metres
MBTU	-	British Thermal Unit x 1000
mil.	-	million
MW	-	MegaWatt
psi	-	pounds per square inch
Ton	-	Long Ton (2240 lbs.)
M.C.	-	moisture content, wet basis (ie: 90% M.C. has 50% water by weight)

CONVERSION FACTORS

1 barrel	=	158.9 litres
1 barrel of #2 fuel oil	=	$6.15 \times 10^{(9)}$ Joules
	=	$5.83 \times 10^{(6)}$ Btu
1 hectare	=	2.47 acres
1 m3 of fuel peat in-situ	=	$2.20 \times 10^{(9)}$ Joules
	=	$2.08 \times 10^{(6)}$ Btu
1 kilogram of oven dried fuel peat (0% M.C.)	=	22,000 kilojoules/kilogram
	=	9,460 Btu/lb.
1 tonne of fuel peat (50% M.C.)	=	$10.0 \times 10^{(6)}$ kilojoules
	=	$9.48 \times 10^{(6)}$ Btu
1 tonne (metric)	=	1,000 kilograms
	=	0.984 ton (long)

NOTE: These are assumed conversion factors as the high heat value of fuel peat (all moisture removed) is dependent upon the degree of decomposition, bulk density and ash content.

APPENDIX 10

OUTLINE SPECIFICATION

1. F.P.I. FISHPLANT
2. MARYSTOWN SHIPYARD
3. JAMIESON ACADEMY

Fuel Storage Silo and Heating Plant Building

The proposed arrangement is a below grade concrete pit storage silo. The heating plant building is a similar arrangement. The structure shall consist of poured reinforced concrete foundation walls (lower level) and a structural steel superstructure covered with pre-finished coloured metal panels and a metal roof deck. The entire upper level is to be insulated.

The silo is mainly hidden from sight and allows peat to be dumped directly into the silo with many types of transportation vehicles that are equipped with a dump. The arrangement is simpler than an above grade silo in that conveyance of peat fuel to the top of the silo is eliminated. The silo shall be equipped with a hydraulically powered cover that can be manually controlled to permit refueling. The silo capacity should be approximately 260 M^3.

The boiler and fuel storage building work shall include:

- site preparation, excavation, utility hook-ups
- all concrete and formwork
- foundations to meet load requirements
- building drain system
- flashings, building trim or other structural supports, brackets or fasteners, and misc. hardware
- concrete anchor bolts for equipment
- interior and exterior painting, floor sealer compounds, concrete waterproofing
- exterior lighting near the fuel dumping door and main door
- interior industrial type lighting

The fuel is removed from the silo floor by a system of scrapers or pusher bars which are positioned to transport the fuel to the main screw or flight conveyer unit.

Combustion Chamber

The combustion chamber is to be designed for 4.11 MW (419 BHP) output when fired with fuel peat at 50% moisture content. Peat consumption at 100% load is expected to be 2,174 kg/hr. Combustion efficiency shall be at least 80%. System shall be capable of achieving a turn down ratio of at least 5:1 for full modulation of heat output.

System shall be complete with combustion air fans, predrying stage and ash removal. Pre-drying stage shall use hot gases generated by combustion to evaporate excessive moisture in the fuel that is delivered to the primary ignition cell. Excessive moisture is evaporated and removed with toxic gases to the gas handling system. Combustion chamber is to be complete with a moveable grid system and automatic ash discharge.

Combustion chamber is to be complete with all safety and operation controls and shall be insensitive to fluctuations in fuel quality and moisture content.

Heat Exchanger (Boiler)

The boiler should be designed as a medium pressure steam system built to ASME standards with a 1,034 kPa design pressure allowing a 550 kPa working pressure and be equipped with standard fittings including safety and operation values, gauges and controls.

Gas Handling System

Gas handling system shall consist of a smoke gas cleaner, discharge fan and stack. Spent gases cooled by the heat transfer process shall be delivered to the fly ash collector. Provision shall be made to re-introduce unburnt fuel back into the primary screw for further combustion. Emission quality shall meet or exceed the requirements of the Newfoundland Air Pollution Control Regulations.

The shipyard peat burning system will consist of one 2.06MW (7.0 million BTUH) unit installed on the southern side of the Main Shed (See Figure 5.5) to tie into a steam distribution system.

Fuel Storage Silo and Heating Plant Building

The proposed arrangement is a below grade concrete pit storage silo. The heating plant building is a similar arrangement to the Fishplant. The structure shall consist of poured reinforced concrete foundation walls (lower level) and a structural steel superstructure covered with pre-finished coloured metal panels and a metal roof deck. The entire upper level is to be insulated.

The silo is mainly hidden from sight and allows peat to be dumped directly into the silo with transportation vehicles that are equipped with a dump. The silo shall be equipped with a hydraulically powered cover that can be manually controlled to permit refueling. The silo capacity should be approximately 109. M^3.

The boiler and fuel storage building work shall include:

- site preparation, excavation, utility hook-ups
- all concrete and formwork
- foundations to meet load requirements
- building drain system
- flashings, building trim or other structural supports, brackets or fasteners, and misc. hardware
- concrete anchor bolts for equipment
- interior and exterior painting, floor sealer compounds, concrete waterproofing
- exterior lighting near the fuel dumping door and main door
- interior industrial type lighting

The fuel is removed from the silo floor by a system of scrapes or pusher bars which are positioned to transport the fuel to the main screw or flight conveyer unit.

Combustion Chamber

The combustion chamber is to be designed for 2.06 MW (70 mil. BTUH) output when fired with peat fuel at 50% moisture content. Peat consumption at 100% load is expected to be 904 kg/hr. Combustion efficiency shall be at least 80%. System shall be capable of achieving a turn down ratio of at least 5:1 for full modulation of heat output.

System shall be complete with combustion air fans, pre-drying stage and ash removal. Pre-drying stage shall use hot gases generated by combustion to evaporate excessive moisture in the fuel that is delivered to the primary ignition cell. Excessive moisture is evaporated and removed with toxic gases to the gas handling system. Combustion chamber is to be complete with a moveable grid system and automatic ash discharge.

Combustion changer is to be complete with all safety and operation controls and shall be insensitive to fluctuations in fuel quality and moisture content.

Heat Exchanger (Heating Plant)

The Heating Plant should be designed as a hot air system and be equipped with standard fittings including safety and operation values, gauges and controls.

Gas Handling System

Gas handling system shall consist of a smoke gas cleaner, discharge fan and stack. Spent gases cooled by the heat transfer process shall be delivered to the fly ash collector. Unburnt fuel shall be re-introduced back into the primary screw for further combustion. Emission quality shall meet or exceed the requirements of the Newfoundland Air Pollution Control Regulations.

The School Peat Burning System shall consist of a 393 kW (40 BHP) portable unit consisting of two buildings (silo and heating plant) completely contained, packaged and ready for tie into the existing heating system. Buildings are to be secured and mounted on a field installed slab on grade located as shown in Figures 5.7 and 5.8.

Fuel Storage Silo:

The proposed arrangement is a self contained building structure mounted on grade adjacent to the existing boiler room. The silo shall be equipped with a manually operated cover with a capacity of 20.5 M^3.

The fuel is removed from the silo floor by a system of scrapes or push bars which are positioned to transport the fuel to the main screw or flight conveyer unit.

Combustion Chamber

The combustion chamber is to be designed for 393 kW (40 BHP) output when fired with peat fuel at 50% moisture content. Peat consumption at 100% load is expected to be 170 kg/hr.

Combustion efficiency shall be at least 80%. The system shall be capable of achieving a turn down ratio of at least 5:1 for full modulation of heat output.

System shall be complete with combustion air fans, pre-drying stage and ash removal. Pre-drying stage shall use hot gases generated by combustion to evaporate excessive moisture in the fuel that is delivered to the primary ignition cell. Excessive moisture is evaporated and removed with toxic gases to the gas handling system. Combustion chamber is to be complete with a moveable grid system and automatic ash discharge.

Combustion changer is to be complete with all safety and operation controls and shall be insensitive to fluctuations in fuel quality and moisture content.

Heat Exchanger (Boiler)

The boiler should be designed as a low pressure hot water system built to ASME standards and be equipped with standard fittings including safety and operation values, gauges and controls.

Gas Handling System

Gas handling system shall consist of a smoke gas cleaner, discharge fan and stack. Spent gases cooled by the heat transfer process shall be delivered to the fly ash collector. Provision shall be made to re-introduce unburnt fuel back into the primary screw for further combustion. Emission quality shall meet or exceed the requirements of the Newfoundland Air Pollution Control Regulations.

APPENDIX 11

TERMS OF REFERENCE

TERMS OF REFERENCE

ENERGY DEMAND AND PEAT FUEL CONVERSION
BURIN PENINSULA

GENERAL

The Department of Mines and Energy as part of an overall assessment of fuel peat resource potential on the Burin Peninsula requires a consultant to review existing commercial/industrial/institutional energy demand in the area.

The project is being funded under the Federal/Provincial Burin Peninsula Development Fund and will be conducted in two phases.

Phase I is designed to determine the potential market for fuel peat in the area from which the optimum size peat harvesting operation will be determined.

Phase II will involve the pre-feasibility conversion potential assessment of two promising industrial facilities selected on the basis of Phase I.

BACKGROUND

Peat on the Burin Peninsula has been harvested since around the turn of this century. This peat is used for domestic heating in lieu of any abundance of forests particularly in the Lamaline-Allan's Island area of the Peninsula.

The idea of peat burning was introduced to the area by Irish settlers who had burned peat in their homeland. Since that time the production of peat has advanced significantly in Ireland. Large scale production of fuel peat started in Ireland during the mid 1940s. The peat developments created employment in economically depressed areas and provided an indigenous fuel. Peat fired electrical generating stations now provide nearly 25 per cent of Ireland's electricity and peat fuel contributes a sizable portion of the country's total energy supply.

There has been a similar growth in fuel peat consumption in Finland. Peat developments in Finland have expanded rapidly in the past 20 years. Many cities and towns in Finland are now dependent on electricity and residential heating provided by centrally located district heating plants.

Peatland development in these two countries has developed well beyond the demonstration stages. The peat operations are controlled by economically viable, state owned and private energy corporations. The methods of production being used in Newfoundland are based on technologies developed in both Finland and Ireland.

Peatland Resource mapping at a reconnaissance scale was carried out in the Burin Peninsula area in 1980 by Northland Associates Ltd. under contract from the Newfoundland Department of Forest Resources and Lands. This preliminary data on the Burin

Peninsula consists of 35 topographic units (scale 1:12,500) that have mapped bogs of size 30 hectares or more. There are approximately 73 bogs in the 100 ha or larger size category, of which 48 are within the Marystown, Lamaline to Fortune loop area of the Peninsula. The reconnaissance Peatland Inventory data currently resides with the Newfoundland Department of Mines and Energy. In 1984 this Department contracted Northland Associates to transfer the existing data (on bogs 30 ha or larger) to computer data forms.

Experience in Europe and other parts of Canada has indicated that a biomass (peat) fuel project requires a large industrial market in order to be successful. The minimum demand to sustain a fuel peat harvesting project is about 5,000 tonnes per year.

Investigations in the Marystown area indicate there are sufficient potential industrial consumers for a peat conversion project to support a fuel peat harvesting project.

The potential economic benefits of peat conversion to the Burin area are many. The conversion of just two plants would result in an estimated reduced consumption of 530,000 gallons of Bunker "C" oil (400,000 gal. for the Marystown fishplant); 130,000 gal. for the Marystown shipyard). This conversion from oil to peat for these two plants would significantly reduce their operating costs and support a harvesting operation of around 10,000 tonnes of peat per year. An additional 6,000 tonnes of

peat (reduced oil consumption of 300,000 gal.) would be required for conversion of the Grand Bank fishplant (if operating) and an additional 1,000 tonnes may be consumed by the domestic market.

The Burin area, therefore, has the potential to support one or more peat harvesting operations producing in the order of 10,000 to 20,000 tonnes per year.

SCOPE OF WORK

Phase I: Energy Demand Survey

It has been the experience in Europe and in other parts of Canada that successful biomass fuel projects require a large primary market for the majority of the fuel peat produced. Secondary markets for the excess peat fuel can usually be found; however, the primary market should be in itself large enough to justify development of the resource. The final report on ths St. Shotts project indicates a similar finding; conversion of a fish processing plant at Trepassey will liekly be essential for the long term commercial success of that project.

There are several large industrial plants on the Burin Peninsula which offer adequate markets (10,000 tonnes per year) for fuel peat when appropriately converted off oil. An Energy Demand Study will provide an accurate indication of this market potential and will also promote an awareness of fuel peat in the local area.

It is not the Department's intention to prejudge the methodology to be used by the selected consultant. However the consultant shall be required to:

(1) Compile a list of potential fuel peat users in the area, whose fuel bills are estimated to be greater than $10,000/year;

(2) Ascertain by a questionnaire or similar method the relevant characteristics of fuel utilization by each of the users including type of fuel, quantity used, type of distribution system, cost of fuel, expansion plans, and other factors which could effect potential conversion to fuel peat, i.e. consumer acceptance, space limitations. Questionnaires are to be followed up by personal interviews if necessary.

(3) Analyze data received and assess the overall potential for fuel peat conversion in the area;

(4) Select two potential users for detailed conversion feasibility studies.

Phase II: Conversion Feasibility Study

The conversion feasibility study will consist of an investigation of the technical and economic factors associated with the conversion of an oil-fired system to peat burning in two selected facilities.

For this phase the selected consultant will be required to:

(1) Conduct a site inspection of the two facilities to determine the physical and operating limitations which may impede a conversion to a peat burning system;

(2) Review the current energy requirements and operating characteristics of the heating plant; in particular, the fuel consumption, steam or hot water production, operation time and load profiles. Establish the optimum operating characteristics for a peat burning boiler.

(3) Specify a peat burning system in sufficient detail to permit accurate budgeting for the project. Components of the system would be:

- burner/boiler unit including piping and electrical systems,
- fuel feed system to the burner,
- fuel storage silo of optional size which would allow automatic recovery of the fuel,
- truck unloading and silo loading station.

(4) Review all fire safety and environmental codes relevant to solid fuel burning systems.

(5) Perform a life cycle cost analysis for each site.

SCHEDULE

The study should be completed and final report submitted by May 15, 1986. A meeting will be held upon submission of a draft report. Three (3) copies of the draft and eight (8) copies of the final report will be required with one unbound copy.

FUNDS AVAILABLE

Level of effort $21,000.

SELECTION PROCEDURE AND PROPOSAL

The consultant will be selected on the basis of quality of personnel, study methodology, time for completion and total cost for both phases. A breakdown of per diem rates for all personnel, expenses and other associated costs should be included for each activity. Two copies of the proposal should be submitted to the address below by January 31, 1986.

John T. Drover, P. Eng.
Manager of Demonstration and Development
Energy Branch
Department of Mines and Energy
P.O. Box 4750
114 Empire Avenue
St. John's, Newfoundland
A1C 5T7
Telephone: 576-2411

APPENDIX 12

RESULTS OF QUESTIONNAIRE SURVEY

Summary of Peat Energy Demand Questionnaire Responses

SIC CODE (1970)	Industry	Location	Response	Oil Litres	Floor Area Sq. Metres	Suitable for Peat Loading?	Room for Peat Storage?	Comments
1000	Poultry	Garnish	No	--	--	--	--	Electric Heat Not Eligible
1000	Poultry	Fortune	Favourable	--	--	Yes	Yes	Possible Future Use
1000	Poultry	Marystown	Favourable	--	--	Yes	Yes	Possible Future Use
4100	Fishing	Marystown	Not Returned	--	--	--	--	
4100	Fishing	Lawn	Not Returned	--	--	--	--	
4100	Fishing	Marystown	Not Returned	--	--	--	--	
10200	Fishplant	Grd. Bank	Favourable	357020	--	No	Yes	
10200	Fishplant	Marystown	Favourable	1719207	10850	Yes	Yes	Chosen for Phase 2 Study
10200	Fishplant	Fortune	Favourable	1457844	--	Yes	Yes	
10200	Fishplant	Burin	Not Returned	--	--	--	--	
10200	Fishplant	St.Lavr.	Not Returned	--	--	--	--	
25100	Sawmill	Marystown	Not Returned	--	--	--	--	
26100	Wood Man.	Marystown	Not Returned	--	--	--	--	
32700	Ship Bldg	Marystown	Favourable	756700	8900	Yes	Yes	Chosen for Phase 2 Study
32800	Boat Bldg	Fortune	Not Returned	--	--	--	--	
35500	Concrete	Marystown	Not Returned	--	--	--	--	
61200	Wholesale	Grd. Bank	Not Returned	--	--	--	--	
61400	Wholesale	Fortune	Favourable	5270	510	Yes	Yes	<$10,000/yr Not Eligible
61400	Wholesale	Fortune	Favourable	--	1300	Yes	Yes	Electric Heat Not Eligible
61400	Wholesale	Garnish	Not Returned	--	--	--	--	
61400	Wholesale	Grd. Bank	Not Returned	--	--	--	--	
61900	Wholesale	Grd. Bank	Not Returned	--	--	--	--	
62400	Wholesale	Grd. Bank	Not Returned	--	--	--	--	
62400	Wholesale	Grd. Bank	Not Returned	--	--	--	--	
62600	Wholesale	Grd. Bank	Not Returned	--	--	--	--	
62900	Wholesale	Marystown	Not Returned	--	--	--	--	
62900	Wholesale	Marystown	Not Returned	--	--	--	--	
62900	Wholesale	Marystown	Not Returned	--	--	--	--	
63100	Wholesale	St.Lavr.	Not Returned	--	--	--	--	
65200	Auto Sup.	Marystown	Not Returned	--	--	--	--	
67300	Hardware	St.Lavr.	Not Returned	--	--	--	--	
80200	Schools	Burin	Favourable	126124	4200	Yes	Yes	Chosen for Phase 2 Study
80200	Schools	Burin	Favourable	33363	1920	Yes	Yes	
80200	Schools	Grd. Bank	Favourable	104825	3900	Yes	Yes	
80200	Schools	Marystown	Favourable	60000	--	Yes	Yes	
80200	Schools	Burin	Favourable	52890	--	Yes	Yes	
80200	Schools	Marystown	Favourable	54980	--	Yes	Yes	
80700	Libraries	Fortune	Not Returned	--	--	--	--	
80700	Libraries	Marystown	Not Returned	--	--	--	--	
83100	Church	St.Lavr.	Favourable	15000	560	Yes	Yes	<$10,000/yr Not Eligible
84900	Comm Cen	Lawn	Not Returned	--	--	--	--	
87400	Laundry	Fortune	Favourable	21000	190	Yes	Yes	
87400	Laundry	Marystown	Not Returned	--	--	--	--	
88100	Hotels	Grd. Bank	Not Returned	--	--	--	--	
88100	Hotels	Marystown	Not Returned	--	--	--	--	
88100	Hotels	Grd. Bank	Not Returned	--	--	--	--	
88100	Hotels	St.Lavr.	Not Returned	--	--	--	--	
88100	Hotels	Marystown	Not Returned	--	--	--	--	
89600	Welding	Marystown	Not Returned	--	--	--	--	

SIC CODE (1970) is the Standard Industrial Classification Code as of 1970 and is used by the Provincial Government

GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF MINES AND ENERGY
P.O. Box 4750, St. John's, Newfoundland, Canada A1C 5T7 • Telex: 016-4724

86 02 11

Dear Sir/Madam:

Re: Development of Fuel Peat Industry
Burin Peninsula

With support from the Burin Peninsula Development Fund, the Department of Mines and Energy will be investigating the potential for the development of a fuel peat industry on the peninsula. It is felt that such an industry would not only create local employment but could offer significant fuel cost reductions to potential users.

In support of our investigation we have authorized Provincial Consultants Ltd. to conduct an energy demand study on our behalf. As part of the study we would appreciate your filling out the attached questionnaire. We have tried to make it as brief as possible so as not to take up too much of your valuable time.

Your participation will be a worthwhile contribution to the study.

Yours truly,

John H. McKillop
Deputy Minister

/jh
Attachment

PEAT ENERGY DEMAND STUDY QUESTIONNAIRE

Coordinator
Peat Energy Demand Study
c/o Provincial Consultants Ltd.
3 Maxse Street
St. John's, Newfoundland
A1C 2S6

FOR OFFICE USE ONLY
SIC #
FILE #

QUESTIONNAIRE FORM 'A'
(Confidential)

1. GENERAL INFORMATION

Company Name: _____

Mailing Address: _____

_____

Nature of Business
(e.g. Fish Processing, Supermarket): _____
Address of Building: _____

Contact Person: _____

Title: _____ Telephone: _____

2. ENERGY USAGE

(Exclude fuel used for transportation and mobile equipment)

Annual Fuel Consumption:

Fuel Type	Units (e.g. litres etc)	Quantity Purchased (12 month period)	Current Cost/Unit

3. OPERATING DATA

Operating hours per week: _____ Number of occupants/employees: _____

Weeks per year of plant/building operation: _____

4. BUILDING DATA

Heated floor space: _____ m3 (f3)

Year of construction: _____

Construction type (brick, steel, wood, etc.): _____

5. SUITABILITY FOR PEAT HEATING SYSTEM

Is there sufficient room for large delivery trucks to manoeuvre near the boiler room? Yes ____ No ____

Type of Heating System
Hot Water _____ Hot Air _____ Steam _____

Is there room for outdoor peat storage? Yes ____ No ____

Are building plans and specifications available on site?
Yes ____ No ____

What is the area of the boiler room: _____ (ft2 ___) (m2 __)

Comments: _____

We are planning to conduct detailed peat fuel conversion feasibility studies of two selected facilities.
Would you be willing to participate in such a study ?
Yes _____ No _____

(This does not commit your firm to a financial contribution)

PEAT ENERGY DEMAND STUDY QUESTIONNAIRE

Coordinator
Peat Energy Demand Study
c/o Provincial Consultants Ltd.
3 Maxse Street
St. John's, Newfoundland
A1C 2S6

FOR OFFICE USE ONLY
SIC #
FILE #

QUESTIONNAIRE FORM 'B'
(Confidential)

1. GENERAL INFORMATION

Company Name: _____

Mailing Address: _____

_____

Nature of Business
(e.g. Fish Processing, Supermarket): _____
Address of Building: _____

_____

Contact Person: _____

Title: _____ Telephone: _____

2. OPERATING DATA

Operating hours per week: _____ Number of occupants/employees: _____

Weeks per year of plant/building operation: _____

3. BUILDING DATA

Heated floor space: _____ m3 (f3)

Year of construction: _____

Construction type (brick, steel, wood, etc.): _____

4. SUITABILITY FOR PEAT HEATING SYSTEM

Is there sufficient room for large delivery trucks to manoeuvre near the boiler room? Yes ____ No ____

Type of Heating System
Hot Water _____ Hot Air _____ Steam _____

Is there room for outdoor peat storage? Yes ____ No ____

Are building plans and specifications available on site?
Yes ____ No ____

What is the area of the boiler room: _____ (ft2 ___) (m2 __)

Comments: _____

We are planning to conduct detailed peat fuel conversion feasibility studies of two selected facilities.
Would you be willing to participate in such a study ?
Yes _____ No _____

(This does not commit your firm to a financial contribution)